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HENRY W. HENSHAW, *Chief*

NORTH AMERICAN FAUNA

No. 37

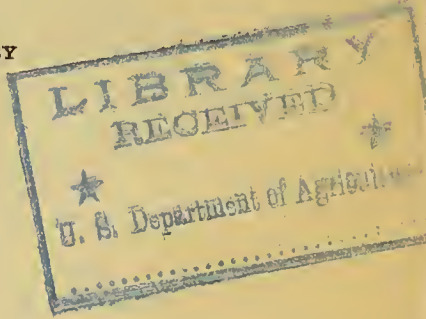
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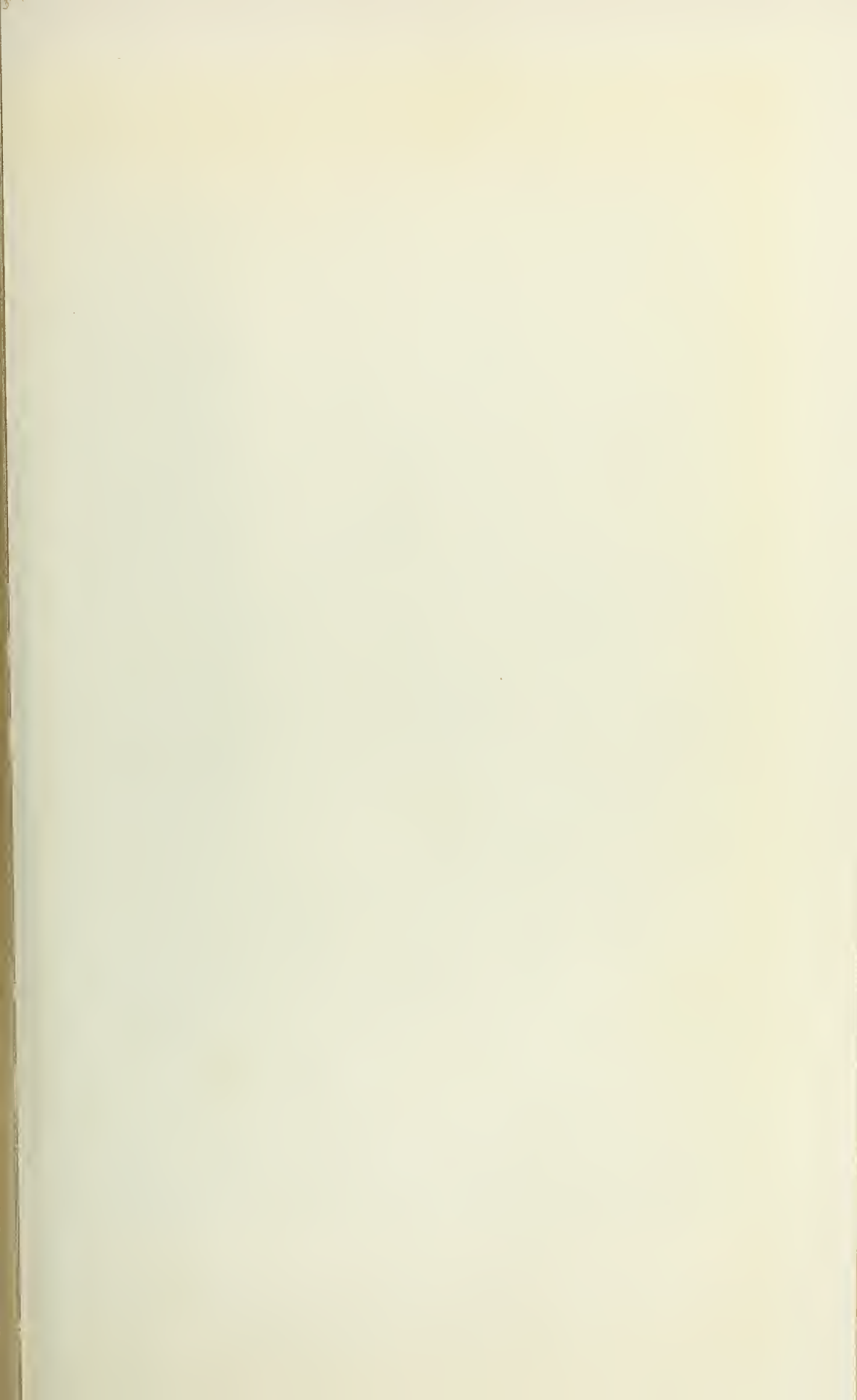
REVISION OF THE AMERICAN MARMOTS

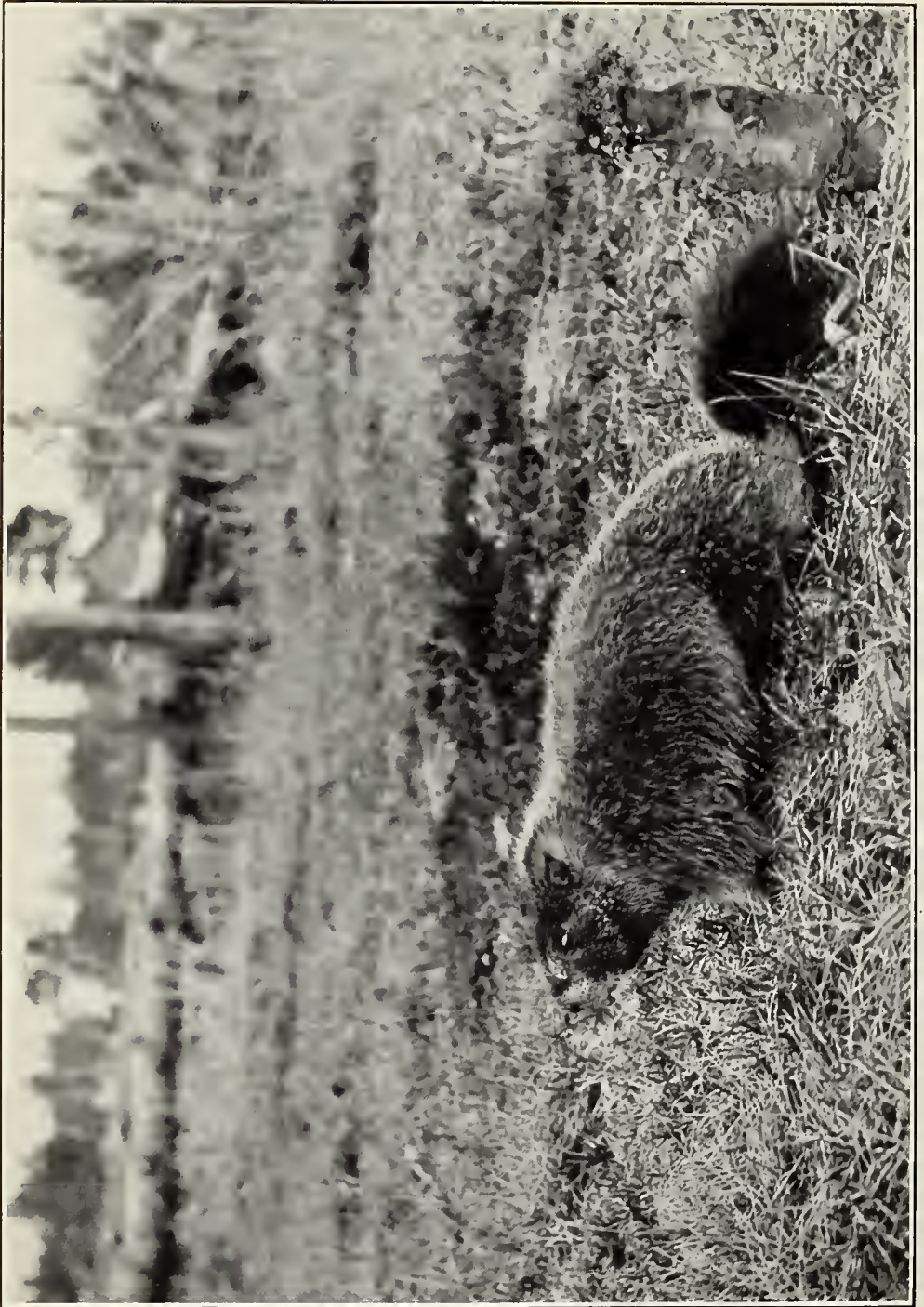
BY

ARTHUR H. HOWELL
ASSISTANT BIOLOGIST, BIOLOGICAL SURVEY



WASHINGTON
GOVERNMENT PRINTING OFFICE
1915





GOLDEN-MANTLED MARMOT (*MARMOTA FLAVIVENTRIS NOSOPHORA*).

[From life: Florence Mont. April, 1910.]

U. S. DEPARTMENT OF AGRICULTURE

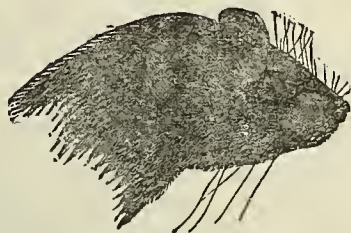
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LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF BIOLOGICAL SURVEY,
Washington, D. C., October 21, 1914.

SIR: I have the honor to transmit herewith for publication as North American Fauna No. 37 a revision of the American marmots, by Arthur H. Howell, assistant biologist of the Biological Survey.

Although marmots are found over most of the United States and Canada, the relationships and ranges of the several species until now have been very imperfectly known. The present report furnishes descriptions of 26 forms and contains a series of maps showing their geographic distribution. In many localities marmots are a decided pest to agriculture, especially in the East, both because they are destructive to crops and because their burrows seriously interfere with farming operations. Moreover, marmots are known to carry the germs of Rocky Mountain spotted fever and other diseases. The animals are hence of considerable economic importance.

Respectfully,

HENRY W. HENSHAW,
Chief, Biological Survey.

Hon. DAVID F. HOUSTON,
Secretary of Agriculture.

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REVISION OF THE AMERICAN MARMOTS.

By ARTHUR H. HOWELL.

INTRODUCTION.

The American marmots, more often called woodchucks or ground hogs, are among the best known of our native wild mammals. They naturally divide into three distinct groups: (1) The woodchucks (*Marmota monax* group) of eastern United States and Canada; (2) the yellow-footed marmots (*M. flaviventris* group) of western United States and southern British Columbia; and (3) the hoary marmots (*M. caligata* group), chiefly restricted to the higher mountains of western North America. The present paper is a revision of the American species only, as it was not possible at this time to include a discussion of the Eurasian forms of the genus.

HISTORY AND NOMENCLATURE.

Widely distributed, in many places abundant, diurnal in habit, and frequently destructive to crops, the eastern species (*monax*) quickly attracted the attention of the early settlers, and through the medium of skins or captive animals sent to Europe soon became known to naturalists.

The first reference in literature to the American marmots dates from 1703, when Baron La Hontan published a very brief account of the woodchuck of eastern Canada, based on his observations in the region about Lake Champlain.¹ The name "siffleur" which he applied to the animal was carried by the French voyageurs throughout the northwestern fur countries and still is current among the French Canadians of the Eastern Provinces.

Catesby, in 1743, gave a brief description of the eastern woodchuck under the name of "The Monax,"² and a few years later, in 1747, Edwards published a more extended account with a very inaccurate figure of the animal under the title of "The Monax or Marmotte of America."³ Edwards's description and figure were copied by many subsequent authors and furnished also the basis of the first technical

¹ La Hontan, Baron de. Voyages dans l'Amerique, 1703, p. 81.

² Catesby, Mark. Nat. Hist. of Carolina, etc., II, 1743, App., p. xxviii.

³ Edwards, George. Nat. Hist. Uncommon Birds, II, 1747, p. 104, pl. civ.

name applied to the species—*Mus monax* Linnaeus.¹ While the figure is wholly unrecognizable, the description is sufficiently clear to warrant the use of the name bestowed by Linnaeus.

Erxleben, in 1777, named the Canadian woodchuck (now recognized as a subspecies of *monax*) "*Glis*" *canadensis*,² and Pallas in the following year renamed it "*Mus*" *empetra*,³ both descriptions being based on the "Quebec marmot" of Pennant.⁴ Blumenbach, in 1779, named the genus *Marmota*,⁵ and Schreber the following year introduced the name *Arctomys monax* on a plate evidently copied from Edwards's figure of "The Monax."⁶ Schreber's generic name, though of later date than Blumenbach's, received general acceptance and continued in common use for the marmots until the early years of the present century, when the name *Marmota* was restored as the proper appellation of the genus.⁷ In 1788, Gmelin proposed the name *Arctomys pruinosa*,⁸ based on the hoary marmot of Pennant, and this name was used for that animal until 1888, when Tyrrell showed that it had been incorrectly applied and proposed to use in its place *Arctomys caligata* Eschscholtz, first described in 1829.⁹

Sabine, in 1822, published an account of the American marmots, recognizing three species: *monax*, *empetra* (= *canadensis*), and *pruinosa* (= *caligata*).¹⁰ His descriptions of *monax* and *pruinosa* were copied from previous authors, but that of *empetra* was drawn from a specimen in the British Museum, and furnished apparently the first correct description of any American marmot. The first accurate drawing of an American species is that of the Canadian woodchuck published by Richardson in the *Fauna Boreali-Americana* (1829).

In 1836 King, recognizing clearly that *pruinosa* of Gmelin was not applicable to the hoary marmot, but overlooking Eschscholtz's name *caligata*, proposed the name *Arctomys okanaganus* for a marmot of this group obtained in southern British Columbia, and gave a very full and accurate description and a good figure of the animal, drawn from a living specimen which he sent to the Zoological Gardens in London.¹¹ His name, however, was not accepted by zoologists, and *pruinosa* continued in use for many years. The specimen taken by King was seen by Audubon in London, and furnished the basis of his

¹ The use of the name "monax" by both Catesby and Edwards independently (Edwards states that he had never seen an account of the animal) indicates that it came from the vernacular—a theory which is strengthened by the fact that the animal is still called "moonack" in parts of southern Virginia.

² Erxleben, J. C. P. *Syst. Anim., Mamm.*, 1777, p. 363.

³ Pallas, P. S. *Nov. Spec. Glir.*, 1778, p. 74.

⁴ Pennant, Thomas. *Syn. Quad.*, 1771, p. 270, Plate 24, fig. 2.

⁵ Blumenbach, J. F. *Handb. der Naturgesch.*, 1, 1779, p. 79.

⁶ Schreber, J. C. D. von. *Säugethiere*, pl. ccviii, 1780; text, 1V, 1782, p. 737.

⁷ Trouessart, E. L. *Cat. Mamm., Suppl.*, 1904, p. 343.

⁸ Gmelin, J. F. *Syst. Nat.*, 1, 1788, p. 144.

⁹ Tyrrell, J. B. *Proc. Can. Inst.*, 3d Ser., VI, 1888, p. 88.

¹⁰ Sabine, Joseph. *Trans. Linn. Soc. London*, X111, 1822, pp. 579-591.

¹¹ King, R. *Narr. Journ. to Shores of Arctic Ocean*, 11, 1836, pp. 232-248.

figure of the hoary marmot in the "Quadrupeds of North America," but the illustration is colored much too brown to represent the animal correctly. In the work referred to¹ the authors gave also an extended account and a good drawing of the eastern woodchuck, and a shorter account, with a figure, of the yellow-bellied marmot of western North America, first described by them in 1841 under the name *Arctomys flaviventer*. This is the first appearance in literature of the widely distributed group of yellow-footed marmots, and the work of Audubon and Bachman was the first treatise in which all three groups of American species were recognized.

Little advance in knowledge of the genus was made for nearly half a century, and the three groups (*monax*, *flaviventris*, and *caligata*) continued to be known by only a single species in each. The Canadian woodchuck, so clearly described by Sabine and Richardson, was considered by both Baird and Allen to be identical with *monax* (of which it is, indeed, a subspecies) and the names based on it (*canadensis* Erxleben, *empetra* Pallas, *melanopus* Kuhl) were placed by them in synonymy, but were later revived by several authors.²

In 1889 Merriam described *dacota*, a member of the *flaviventris* group, from the Black Hills, S. Dak.; and in 1898, *olympus*, a member of the hoary marmot group, from the Olympic Mountains, Wash. In 1899 Bangs named *ignava* from Labrador and *avara* from southern British Columbia; in 1905 J. A. Allen described *engelhardti* from Utah; in 1909 Heller proposed *vigilis* for a hoary marmot from Alaska; in 1911 Swarth named *ochracea* from Alaska and *vancouverensis* from British Columbia; and in 1912 Hollister proposed the name *sibila* for a hoary marmot from the northern Rocky Mountains, but as this name was found to be preoccupied the species was renamed by him *oxytona* in 1914. The present writer, after making a preliminary study of the group, added, in 1914, 10 new forms to the 13 currently recognized.³ Two additional new races are here described and one old name (*okanagana*) is revived, making a total of 26 forms recognized in this revision.

VERNACULAR NAMES.

The marmots of the *monax* group are known in the Northern States as woodchucks, and in the Southern States as ground hogs, the European name marmot being practically unknown in eastern North America. In eastern Canada, among the French Canadians, the name "siffleur" is current, and in central Canada the Cree Indian

¹ Audubon & Bachman. Quad. N. Am., I, 1841, pp. 16-24, [pl. ii; III, 1854, pp. 17-20, pl. ciii; pp. 160-162, pl. cxxxiv.

² Rhoads, S. N., Proc. Acad. Nat. Sci. Phila., 1897, p. 30; Allen, J. A., Bul. Amer. Mus. Nat. Hist., X, 1893, p. 456; Preble, E. A., N. Am. Fauna No. 22, 1902, p. 47; Ibid., No. 27, 1908, p. 159.

³ Howell, A. H. Proc. Biol. Soc. Washington, XXVII, 1914, pp. 13-18.

name "wenusk" is generally used. In southern Virginia, as I am informed by Edward A. Preble, the woodchuck is locally known as "moonack," which is probably a corruption of the original name "monax" used by both Catesby and Edwards.

The yellow-footed marmots (*flaviventris* group) are commonly called woodchucks or rockchucks, more rarely ground hogs or marmots.

The hoary marmots (*caligata* group) are most often known as ground hogs, whistlers or "siffleurs," sometimes as whistling "pigs," whistling marmots, or "badgers."

HABITS.

The eastern woodchucks live for the most part in pairs or family groups, the yellow-footed marmots in more or less scattered colonies, while the hoary marmots are more strongly gregarious. All the species live in burrows which they dig for themselves. In regions where rock piles, rock ledges, or stone walls occur the burrows are usually excavated underneath or among rocks, but natural openings in cliffs are often utilized for dens.

Eastern woodchucks (*monax* group), while preferring rocky bluffs or stone walls for a habitation, often live in meadows devoid of rocks and where the burrows are surrounded by an abundant growth of grass or clover.

Yellow-footed marmots (*flaviventris* group) usually live either on rocky hillsides, in the crevices of cliffs, or beneath rock piles in meadows. They frequently make their burrows beneath unoccupied buildings, but are never found far from hills, and are often abundant in the higher parts of mountains.

Hoary marmots (*caligata* group), when living at timber line in the mountains, as is their invariable habit in the southern part of their range, are always found in or about rock slides, but in Alaska and northern British Columbia, where they frequently descend to low altitudes, they often make their burrows in grassy flats or on open hillsides.

All the species are mainly terrestrial, but the eastern woodchucks occasionally climb into trees and bushes. They are not at home, however, in such situations, and as a rule may easily be dislodged. The tree-climbing habit appears to be more strongly marked in the woodchucks of the Mississippi Valley than in those inhabiting the Atlantic States. Charles Aldrich, of Webster City, Iowa, has recorded an instance of a woodchuck ascending an oak tree to a height of 40 feet,¹ and Dr. F. W. Langdon states that in Ohio he has seen one descend the perpendicular trunk of a large sugar maple, *head first*.² In Minnesota and Wisconsin, as I am informed by Vernon

¹ Aldrich, Charles. Am. Naturalist, XV, 1881, p. 737.

² Langdon, F. W. Journ. Cincinnati Soc. Nat. Hist., III, 1880, p. 305.

Bailey and H. H. T. Jackson, it is a common occurrence for woodchucks to take to trees when pursued by dogs.

The eastern woodchuck is mainly diurnal, but occasionally is found abroad at night also, especially by moonlight. Merriam says of it:

In summer, throughout the farming districts, they commonly leave their burrows early in the morning, late in the afternoon, and during moonlight nights, but may sometimes be found abroad at all hours. As autumn approaches, and they become more and more fat and sleepy, they usually appear only in fine weather, and then but for a few hours in the hottest part of the afternoon.¹

The yellow-footed and hoary marmots are fond of sunning themselves on projecting points of rock where they are safe from attack and may overlook a wide stretch of country. During cloudy and stormy weather they are less active and spend a larger part of the time in their burrows.

All the American marmots when alarmed utter a loud, shrill whistle, a habit apparently most pronounced in the hoary marmot, whose notes are much stronger than those of the smaller species and capable of being heard at a distance of more than a mile. This habit has given the name "whistler" to the hoary marmot and "siffleur" to the woodchuck of eastern Canada.

BURROWS.

Although originally living in the woods, the eastern woodchuck prefers clearings for its abode; and, as a result of an abundance of easily obtained food, is now probably much more numerous than in primitive times. Its burrows are commonly excavated in the face of a bluff, in a grassy meadow, or underneath a stone wall, a stump, or the roots of a tree.

Merriam states that the burrows are of two principal types—

* * * the first slopes at a moderate angle from the surface and has a mound of dirt near its entrance; the other is more or less vertical for several feet (often a metre or more) immediately below the surface, and no loose earth can be found in its neighborhood. * * * As a rule they [the galleries] slant abruptly downward from the entrance to a depth of from three to four feet * * * , whence inclining slightly upward and usually curving to one side, they extend horizontally for a varying distance (commonly from 10 to 25 feet) * * *. Two or more short lateral branches are generally given off from the main gallery, and lead, sloping upward and then downward, to the more or less circular chambers that contain the animals' nests. It has been my invariable experience to find these chambers above the level of the bottom of the entrance incline, and I have seen one that was within a foot and a half * * * of the surface. The nest itself is usually composed of dry grasses and leaves and rarely exceeds a foot in diameter. * * * The main gallery or one of its branches commonly terminates in a slight excavation, which is found to contain the animal's excrement.²

¹ Merriam, C. H. Mamm. of the Adirondacks, Trans. Linn. Soc. N. Y., II, 1884, p. 146.

² *Ibid.*, pp. 148-149.

William Hubbell Fisher excavated and measured nine burrows of the woodchuck in Lewis County, N. Y., and has published a detailed description of them, with diagrams. The longest burrow which he examined measured (including side branches) 44 feet 9½ inches; the shortest, 6 feet 8¼ inches; the deepest burrow was 49 inches below the surface; the shallowest, 23 inches.¹

No description of the burrows of the yellow-footed marmot has come to the writer's notice, and the only known account of those of the hoary marmots is that given by William H. Wright in his work on the grizzly bear. Describing the manner in which a grizzly had opened up a den of these marmots, he says:

The den ran in under several layers of loose flat rocks, some of which were two or three feet long by half as many wide, and several inches thick. These he had ripped out easily and thrown down hill, and the dirt and small bowlders had been hurled out and now covered the snow all about for a space of ten or twelve feet.

On the rocks and snow were large spots and blotches of blood, telling of the feast that had rewarded his labors, and that there had been more than one marmot was shown by the numerous tracks. These animals had burrowed down some six or seven feet into the side of the mountain, and under a large flat stone they had scooped out a little cave, some three feet in diameter, where they had a soft bed of grasses that they had carried in. When the grizzly broke his way into their home there had been a great rush for freedom.

The marks in the snow indicated that all the marmots had been devoured by the bear.²

HIBERNATION.

All the species hibernate for periods varying from 4 to 6 months. Merriam states that in New York, along the western border of the Adirondacks, the woodchuck usually goes into winter quarters between the 18th and 25th of September and reappears the middle or latter part of March; in early springs following mild winters, he adds, "woodchucks occasionally appear in February, but reenter their burrows and again become dormant if the temperature falls."³ Bachman states that he once observed a woodchuck in New York State on October 23 sunning himself at the mouth of his burrow, and also in the same State saw one killed by a dog on March 1.⁴ Extreme dates of occurrence for this region are: February 22, Adirondack Mountains, N. Y., specimen in the Merriam collection; and November 20, Fort Miller, N. Y., one seen by Dr. E. A. Mearns.⁵ In the more southern States, hibernation covers a shorter period, as indicated by the occurrence of the animals at the base of Roan Mountain, N. C., as early as February 7 and as late as October 23. Other dates

¹ Fisher, W. H. *Jour. Cincinnati Soc. Nat. Hist.*, XVI, 1893, pp. 105-123.

² Wright, W. H. *The Grizzly Bear*, London, 1909, p. 82.

³ Merriam, C. H. *Mamm. of the Adirondacks*, *Trans. Linn. Soc. N. Y.*, II, 1884, pp. 143-144.

⁴ Audubon & Bachman. *Quad. N. Am.* I, 1849, p. 20.

⁵ Mearns, E. A. *Bul. Amer. Mus. Nat. Hist.*, X, 1898, p. 337.

of late occurrence are as follows: October 6, Teslin Lake, Yukon; October 17, Dowagiac, Mich.; October 25, Johnson County, Iowa. Hahn states that in southern Indiana woodchucks usually retire about the middle of October and begin to clean out and enlarge their burrows during the last days of February.¹

The yellow-footed marmots go into hibernation between the middle of August and the first of October, the date varying with the altitude and local conditions. Individuals living in the valleys retire earlier than those living higher up in the mountains. Warren states that in Gunnison County, Colo., this species dens up about the first of October, but individuals are sometimes seen much later.² Allan Brooks states (in epistle) that at Okanogan Landing, British Columbia, practically all these marmots disappear before the middle of August, but he has occasionally seen their tracks as late as early October. In the mountains of Montana and Wyoming this species usually enters hibernation during the last of August or the first of September; Biological Survey field parties have never found the animals later than the first week in September. In the Bitterroot Valley, Mont., the first one seen in the spring in 1910 was on March 24, and by April 1 they were numerous; in 1911 one was seen there by Bernard Bailey, on March 13. In western Oregon extreme dates of occurrence are: February 4 (Klamath Lake), and September 25 (Mount Hood).

The hibernating period of the hoary marmot begins the last of September or first of October. Near Tatletuey Lake, British Columbia, Edward A. Preble found the species still active a few hundred feet above timber line on September 23 and 25, but none was seen after the latter date. Like the yellow-footed species, the hoary marmots retire earlier in the valleys than in the mountains. Heller states that at Valdez Narrows, Alaska, the species went into hibernation about the middle of September.³

Bachman thus described his observations of a pair of hibernating marmots:

In the summer of 1814, in Rensselaer County, in the State of New York, we marked a burrow which was the resort of a pair of marmots. In the beginning of November the ground was slightly covered with snow, and the frost had penetrated to the depth of about an inch. We now had excavations made in a line along the burrow or gallery of the marmots, and at about twenty-five feet from the mouth of the hole; both of them were found lying close to each other in a nest of dried grass, which did not appear to have been any of it eaten or bitten by them. They were each rolled up, and looked somewhat like two misshapen balls of hair, and were perfectly dormant. We removed them to a haystack, in which we made an excavation to save them from the cold. One of them did not survive the first severe weather of the winter, having,

¹ Hahn, W. L. *Mamm. of Indiana*, 1909, pp. 481-482.

² Warren, E. R. *Mamm. of Colorado*, 1910, p. 148.

³ Heller, Edmund. *Univ. of California Pub. Zool.*; V, 1910, p. 339.

as we thought on examining them, been frozen to death. The other, the male, was now removed to a cellar, where he remained in a perfectly dormant state until the latter part of February, when he escaped before we were aware of his reanimation. We had handled him only two days previously, and could perceive no symptoms of returning vivacity.¹

The following account of a yellow-footed marmot (*Marmota flaviventris* subsp.) found in midwinter in the Silver Mountain tunnel at Ophir, Colo., probably indicates a common method of hibernation in that species:

* * * [He] had packed in grass for a nest, and taken up his winter quarters. He was rolled up like a ball, with his forepaws over his eyes; we pulled his paws away, and his eyes were closed; all our efforts to awake him were futile; he would yawn like a boy that had been disturbed when sleeping soundly, return his paws to his eyes, and curl himself up in his original position.²

BREEDING.

The eastern woodchuck usually produces from 4 to 6 young at a birth. Bachman states, however, that on two occasions he counted 7 and on another 8 young in a litter, and H. H. T. Jackson informs me that he once saw a litter of 9. In New York State, according to Merriam, this species brings forth its young the last of April or first of May. In the Southern States they are born somewhat earlier.

The yellow-footed marmots breed at about the same season as their eastern relatives and produce from 3 to 8 young at a birth. In the Bitterroot Valley, Montana, 5 females collected between April 8 and April 16 were pregnant, the number of embryos being in most cases 5 or 6 (in one case 3). Young marmots were out in numbers in that region on May 30. Warren states that an individual of this species collected at Sulphur Springs, Colo., on May 4, contained 8 embryos.³

The hoary marmots probably breed somewhat later than their smaller relatives, but little information on this point is available. A female specimen of *Marmota caligata nivaria*, taken May 27, 1895, near St. Marys Lake, Mont., contained 5 embryos. Swarth states that in southern Alaska young individuals of *M. c. caligata* were seen running about in the middle of June, but on Vancouver Island, during the first three weeks of July, no young ones [of *M. vancouverensis*] had yet emerged from the burrows.⁴

FOOD.

The principal food of the eastern woodchuck is clover, alfalfa, and grass, and the animals do considerable damage to these crops both

¹ Audubon & Bachman. Quad. N. Am., I, 1819, p. 22.

² Osborn, S. E. The Observer, III, 1892, p. 32.

³ Warren, E. R. Mamm. of Colorado, 1910, p. 148.

⁴ Swarth, H. S. Univ. of California Pub. Zool., X, 1912, p. 90.

by consuming the forage and by trampling down much that they do not eat. Cultivated crops and orchard trees are occasionally injured by them, but the damage usually is not serious. Evermann and Clark state that in Indiana woodchucks—

* * * sometimes damage young corn plants and occasionally feed on the leaves of pumpkin, squash, and bean vines. They sometimes visit the kitchen garden and do more or less damage to the cabbage heads and celery.¹

Brooks, writing of the woodchuck in West Virginia, says:

* * * Feeds on corn in the roasting-ear, which it procures by breaking down the stalks; is also fond of pumpkins, young beans, grass and other cultivated crops. Frequently gnaws and scratches the bark of young fruit trees.²

Hahn mentions capturing a woodchuck in a sassafras tree and finding its stomach gorged with sassafras leaves.³ Dr. Witmer Stone states that the woodchuck sometimes eats cantaloupes.

The food of yellow-footed marmots is similar to that of eastern woodchucks, but probably includes a larger proportion of wild plants and less grass and clover. Vernon Bailey found in the stomachs of the Black Hills marmot flowers, leaves, and green seeds of various plants, including *Astragalus bisulcatus* and *Sedum douglasii*. In dry excrement of marmots at Spokane Bridge, Wash., he found the seeds of *Amelanchier alnifolia* and *Rubus nutkanus*. Birdseye states that the marmots in the Bitterroot Valley, Montana, feed on timothy, clover, alfalfa, dandelions, and other native plants. He says:

In hayfields they consume a very considerable amount of feed; and beans, carrots, potato vines, cabbage, and other garden truck are almost sure to suffer whenever woodchucks have access to them.⁴

Little is known definitely concerning the food habits of hoary marmots, but they doubtless feed, like the other species, on grass and the tender leaves and stems of native plants.

ECONOMIC STATUS.

As already shown, the food habits of the American marmots make the animals a decided pest wherever they occur about cultivated lands. In this respect the woodchucks of the Eastern States are the chief offenders, and the farmers of that region wage constant warfare on the animals, with indifferent success. Where the woodchucks occupy mowing lands they not only consume considerable grass and tread down much more which can not be cut by a mowing machine, but their burrows and mounds make it difficult and dangerous to operate a mower. Horses sometimes are injured by stepping into the holes made by woodchucks, and the knives of

¹ Evermann & Clark. Proc. Washington Acad. Sci., XVII, 1911, p. 13.

² Brooks, F. E. Report W. Va. Board Agr. for 1910 (1911), p. 15.

³ Hahn, W. L. Mamm. of Indiana, 1909, p. 482.

⁴ Birdseye, Clarence. Farmers' Bul. 484, U. S. Dept. Agr., 1912, p. 28.

the machines are liable to be dulled or broken by running into piles of earth or rocks. Vernon Bailey states that he has seen an acre of oats on a hillside in New York State almost ruined by a family of woodchucks, their trails having broken down most of the grain which they had not cut to eat.

The fur of the American marmots is not at present used commercially, but the hides of hoary marmots are employed to some extent by the Indians of western Canada for making robes. The fur of this animal is fully as good as that of the European and of some of the Asiatic species, all of which figure extensively in the fur trade. Furthermore, the American animal is larger than most of the Eurasian species, and the color pattern of its skin is such as to make a very handsome natural fur. If a sufficient number of these pelts could be secured in late autumn when they are in prime condition there would seem to be every reason for utilizing them in the fur trade. In parts of Alaska and northern British Columbia the animals are very abundant, and Indians of that region annually capture large numbers both for fur and flesh. The yellow-footed marmots are considerably smaller than the hoary marmots, but their pelage is long, full, and silky, and could readily be made into a very attractive fur. The pelage of the eastern woodchuck is much coarser and thinner and has never been considered of much value for fur; the hides, however, are tough and durable and might be utilized for some kinds of leather. Farmers' boys often tan the skins of the eastern woodchuck and make them into shoe strings, whip lashes, ball covers, or mit facings.

The flesh of marmots is said to be palatable and in certain regions of the Northwest furnishes an important food supply for the native Indians.

MARMOTS AS CARRIERS OF DISEASE.

For many years the opinion has generally prevailed that the marmots of central Asia are in some way concerned in the spread of the plague, and this theory was accepted even as late as 1911 by the members of the International Plague Conference held at Mukden in April of that year. Accounts have frequently been published in medical literature of the appearance of the disease among "targagan"¹ hunters under circumstances pointing strongly to the possibility of infection from handling the animals or consuming their flesh, but unfortunately none of these accounts shows bacteriological evidence of the existence of the plague among marmots, nor do they demonstrate conclusively that the disease is contracted in any way from the animals.²

¹ This is the name applied in medical literature to the marmots of Asia. It is said to be of Mongolian origin. The Russian name of the animal is "churok."

² See especially an article by Dr. Frank G. Clemow, *Jour. Trop. Medicine*, February, 1900, pp.169-174.

The last great outbreak of pneumonic plague in Manchuria, during the winter of 1910–11, was supposed to have started among tarbagan hunters in the town of Manchouli, a station on the Trans-Siberian Railway, whence it spread rapidly southward along the railway to Harbin and Mukden. Efforts were made during the progress of this epidemic to locate the disease among the native marmots,¹ and a number of individuals captured near Mukden were inoculated experimentally by Prof. Zabolotny and found susceptible to plague infection. One individual suffering from the disease was brought to him, this being the only known instance of the natural appearance of plague among marmots.² More recently a systematic effort has been made by the Chinese Government to discover the disease in nature, but the evidence obtained is wholly of a negative character.³

The experimental evidence just mentioned and the close relationship of marmots to ground squirrels, which are known to carry plague on the Pacific coast of North America, warrant looking upon these animals with suspicion whenever they occur in a plague-infested region.

One American species—the golden-mantled marmot (*Marmota flaviventris nosophora*)—is known to assist in spreading the deadly spotted fever by serving as host for the fever tick (*Dermacentor venustus*), both in adult and nymphal stages. Over 200 ticks have been taken from a single wild marmot, and when in captivity the species has been shown to be susceptible to spotted fever.⁴ Since this marmot is not utilized for fur there is relatively little danger of the spread of the disease to other regions through the medium of the animals, but every effort should be made to exterminate them where they occur about cultivated lands or in the vicinity of dwellings. Suggestions for destroying marmots are given in Farmers' Bulletin 484, United States Department of Agriculture.

EXTERNAL CHARACTERS.

In the American marmots the body is thickset and clumsy; the head short and broad; the legs short and stout; and the tail rather short (about one-fifth to one-third of the total length), densely haired, and slightly flattened. The nose is broad and blunt, covered with hair to the edge of the nostrils, and the ears are short, broad, rounded, and well-haired. Tufts of long black bristles grow from the side of the head, one directly behind the nose, another underneath and between the eye and ear, and a third shorter tuft over the eye; small scattered bristles also are found under the chin. The eyes are rather

¹ The marmot of Manchuria, although generally referred to in plague literature as *Arctomys bobac*, is in all probability *Marmota sibirica*, specimens of which, collected at Urga, Mongolia, are in the U. S. National Museum.

² Strong, R. P. Rept. Intern. Plague Conference held at Mukden, April, 1911. Manila, 1912.

³ Dr. Wu Lien Teh (G. L. Tuck). The Lancet, London, Aug. 23, 1913, pp. 529–535.

⁴ Birdseye, Clarence. Farmers' Bul. 484, U. S. Dept. Agr., 1912, p. 28.

small and nearly or quite circular. The feet are robust, with stout, slightly curved fossorial claws, those on the fore feet somewhat heavier; the thumb of the front foot (in the American species) is rudimentary and often very small, but bears a broad, flat nail; the third digit is the longest, the second and fourth subequal, the fifth decidedly shorter; the palm is naked, bearing 3 pads at the bases of the digits and 2 larger posterior ones; on the hind foot the third digit is slightly longer than the subequal second and fourth, the fifth and first successively much shorter; the sole is naked except at the heel and bears 6 pads, 4 at the bases of the digits and 2 posterior to them. The mammae number 5 pairs, except in the *monax* group, in which there are usually but 4 pairs. In *M. monax*, according to Baird, "there is a short, shallow cavity between the muscles of the jaw and the check, attaining a depth perhaps of half an inch or less and occupying the place of the internal pouch of *Tamias* and *Spermophilus* [*Citellus*]." ¹

PELAGE AND MOLT.

The pelage of the American marmots consists of hairs of two kinds—a dense, soft, and somewhat woolly underfur, confined chiefly to the back and sides; and longer, somewhat coarser hairs covering the whole body, intimately mixed on the back with the underfur and projecting beyond the tips of the latter. The underfur is of two colors, usually some shade of gray or dark brown tipped with a lighter color, generally a shade of gray, buff, cinnamon, or reddish brown. The long hairs are also of two colors, usually a shade of brown, hazel, or black, tipped with a lighter shade—buff or white. The tips of the underfur usually show through the long hairs, and form an important element in the general color tone of the pelage. The hairs on the head and feet are shorter than on the rest of the body, and are unicolor to the roots; those on the tail are long and coarse, their bases of a darker shade than the tips. The hair on the underparts is shorter and sparser than on the back and is without underfur.

The pelage is renewed annually in summer, usually in August, sometimes in July or even June. Individuals taken in early spring, soon after emerging from hibernation, are usually in full, long pelage, but by midsummer the pelage often becomes very much worn and faded. There seems to be no uniform method of molting, the new pelage sometimes appearing in patches on various parts of the body. In a specimen of *Marmota olympus*, taken August 28, the new pelage was coming in in large patches, the molt being farthest advanced on the middle of the back, with streaks of new hair along the sides of the neck and body. (Sec Pl. II.) In another individual of the same species, taken August 18, new hair was coming in on the rump and

¹ Baird, S. F. Mamm. N. Am., Rept. Expl. and Surv. R. R. Pacif., VIII, 1857, p. 340. The author has had no opportunity to examine specimens of any of the groups in the flesh, so does not know whether this character is possessed by all.

hinder back, the old intimately mixed with the new. In an immature individual of *M. caligata cascadiensis*, taken August 5, new pelage covered all of the body except the rump and tail. A somewhat similar condition is shown by an adult individual of *M. monax prebtorum*, taken July 11, the new pelage coming in over the entire upperparts, farther advanced on the fore back and shoulders. In a specimen of *M. flaviventris nosophora*, taken June 7, the molt was just beginning in two patches on the hinder back. In a specimen of *M. f. obscura*, taken July 27, new pelage appears in the form of a band on the middle of the back reaching from the top of the head to the rump. (See Pl. II.)

MELANISM.

Melanism is most strongly developed in the subspecies *Marmota caligata vigilis*, occupying the region around Glacier Bay, Alaska. In this race some individuals are entirely black except for a few grayish hairs on the sides and neck, and small whitish patches on the underparts and nose. No purely black specimens of *M. monax* have been seen, but a melanistic phase is rather common in New York and New England. The darkest specimen seen (from Lake George, N. Y.) is dark blackish brown all over, except the head and face, which are mixed mummy brown and benzo brown. Other specimens from New York State are dark chestnut-brown. Vernon Bailey states that he has seen a very few black individuals in Minnesota.

A dark phase occurs also in *M. flaviventris luteola*, but this can hardly be said to be melanistic (see description under that species). A curious specimen of *M. f. avara* from Pullman, Wash., has the tips of the hairs of the head, fore back, and most of the underparts dark blackish brown, the hinder back being pale grayish mixed with dark brown.

MATERIAL EXAMINED AND ACKNOWLEDGMENTS.

The present revision is based on a study of 1,051 specimens, 722 of which are contained in the U. S. National Museum, including the Biological Survey and the Merriam collections; the remainder (329 specimens) have been borrowed from other museums and from private collections. For the loan of this material I desire to extend my thanks to the following: Dr. J. A. Allen, of the American Museum of Natural History; Messrs. Samuel Henshaw and Outram Bangs, of the Museum of Comparative Zoology; Dr. Witmer Stone, of the Academy of Natural Sciences, Philadelphia; Dr. W. J. Holland and Mr. W. E. Clyde Todd, of the Carnegie Museum; Dr. A. G. Ruthven, of the University of Michigan; Messrs. Charles B. Cory and W. H. Osgood, of the Field Museum of Natural History; Mr. C. D. Bunker, of the Kansas University Museum; Prof. C. C. Nutting, of the University of Iowa; Mr. J. D. Figgins, of the Colorado Museum of Natural

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EXPLANATION OF CRANIAL MEASUREMENTS.

Measurements of skulls of marmots, in millimeters, have been taken as follows:

Condyllo-basal length.—From posterior border of condyle to most anterior point of premaxillae.

Palatal length.—From posterior border of palate (disregarding median process) to most anterior point of premaxillae.

Postpalatal length.—From posterior border of palate to inferior lip of foramen magnum.

Length of nasals.—From most anterior point to most posterior point.

Zygomatic breadth.—Greatest breadth across zygomata.

Breadth across mastoids.—Greatest breadth across mastoid processes.

Least interorbital breadth.—Shortest distance across frontals in front of postorbital processes.

Breadth of rostrum.—Greatest breadth of rostrum at most anterior points of maxillae.

Maxillary tooth row.—Alveolar length of maxillary molar-premolar tooth row.

Genus *MARMOTA* Blumenbach.

Glis Erxleben, Syst. Regni Anim., I, 1777, p. 358 (part). (Not *Glis* Brisson, 1762.)

Marmota Blumenbach, Handb. der Naturgesch., I, 1779, p. 79. Type, *Marmota alpina* [= *Mus marmota* Linnaeus].

Arctomys Schreber, Säugthiere, 1780, Plate CCVIII. Type, *Mus monax* Linnaeus.

GROUPS.

The American marmots embrace three very distinct groups as follows: (1) The *monax* group—all the eastern woodchucks, the Canada woodchuck, the British Columbia woodchuck and the ochraceous woodchuck of Alaska and northern British Columbia; (2) the *flaviventris* group—all the yellow-footed marmots; and (3) the *caligata* group—the hoary marmots, including the species *caligata*, *olympus*, and *vancouverensis*. The characters of the various groups are given in connection with the technical descriptions of the species.

A detailed study of Old World forms was not possible in the present revision, but, so far as known, none of the American species has any very near relative in Eurasia.¹ Several groups are represented there, some of the species resembling the *caligata* group in certain skull characters, others apparently being more nearly related to the *monax*

¹ The species living in eastern Siberia has not been seen.

group. *Marmota marmota*, the type of the genus, though widely differing from the American species in the greater depth and convexity of the cranium, resembles *monax* in the characters of the basioccipital, the shape of the postorbital processes, the relatively wide interorbital region, and the nearly parallel maxillary tooth rows. Most of the Asiatic species, however, apparently are more closely related to *M. caligata* than to either of the other American groups. The skulls of all American species, contrasted with those of the Eurasian species, show a marked flattening of the cranium, the dorsal outline of the skull being decidedly more convex in practically all Old World forms than in those of America. All the Eurasian species differ also in coloration from the American forms. All the American species possess a small rudimentary thumb bearing a flat nail—a character present in most of the Asiatic species, but absent in *M. marmota* of Europe.

List of American Species and Subspecies, with Type Localities.

Marmota monax group:

- Marmota monax monax* (Linnaeus)..... Maryland.
monax rufescens Howell..... Elk River, Minn.
monax preblorum Howell..... Wilmington, Mass.
monax ignava (Bangs)..... Black Bay, Labrador.
monax canadensis (Erxleben)..... "Canada et ad fretum Hudsonis"—
fixed at Quebec, Quebec.
monax petrensis nobis..... Revelstoke, British Columbia.
monax ochracea Swarth..... Head of Fortymile Creek, Alaska.

Marmota flaviventris group:

- Marmota flaviventris flaviventris* (Audu-
bon & Bachman)..... "Mountains between Texas and Cali-
fornia"—fixed on Mount Hood, Oreg.
flaviventris avara (Bangs)..... Okanogan, British Columbia.
flaviventris sierrae nobis..... Mount Whitney, Cal.
flaviventris parvula Howell..... Jefferson, Toquima Range, Nev.
flaviventris engelhardti Allen..... Beaver Mountains, Utah.
flaviventris nosophora Howell..... Willow Creek, 7 miles east of Corvallis,
Mont.
flaviventris dacota (Merriam)..... Custer, S. Dak.
flaviventris luteola Howell..... Woods P. O., Medicine Bow Mountains,
Wyo.
flaviventris warreni Howell..... Crested Butte, Colo.
flaviventris obscura Howell..... Wheeler Peak, N. Mex.

Marmota caligata group:

- Marmota caligata caligata* (Eschscholtz) . Bristol Bay, Alaska.
caligata vigilis Heller..... Glacier Bay, Alaska.
caligata sheldoni Howell..... Montague Island, Alaska.
caligata oxytona Hollister..... Head of Smoky River, Alberta.
caligata okanagana (King)..... Gold Range, British Columbia.
caligata nivaria Howell..... Mountains near St. Marys Lake, Mont.
caligata cascadiensis Howell..... Mount Rainier, Wash.
Marmota olympus (Merriam)..... Olympic Mountains, Wash.
Marmota vancouverensis Swarth..... Mount Douglas, Vancouver Island, Brit-
ish Columbia.

Key to American Species and Subspecies.

[Based on typical adults.]

- a. Upperparts mainly black and white (shaded with cinnamon-buff on rump).
- b. Underparts mainly white.
- c. Size small; condylo-basal length of ♀ skull less than 90 mm. . . . *sheldoni* (p. 62).
- c'. Size large; condylo-basal length of ♀ skull more than 90 mm.
- d. Skull shorter; condylo-basal length in ♀ less than 98 mm. . . . *caligata* (p. 59).
- d'. Skull longer; condylo-basal length in ♀ more than 98 mm. . . . *nivaria* (p. 66).
- b'. Underparts dusky (blackish brown, soiled whitish, or clay color).
- c. Skull relatively short and broad; condylo-basal length in ♂ less than 101 mm.; in ♀ less than 98 mm.
- d. Nasals shorter, rarely extending back of posterior ends of premaxillae. . . . *okanagana* (p. 64).
- d'. Nasals longer, always extending back of posterior ends of premaxillae. . . . *vigilis* (p. 61).
- c'. Skull relatively long and narrow; condylo-basal length in ♂ more than 101 mm.; in ♀ more than 95 mm.
- d. Upperparts whiter; skull relatively broader (ratio of zygomatic breadth to condylo-basal length 64-67) *cascadensis* (p. 67).
- d'. Upperparts blacker; skull relatively narrower (ratio of zygomatic breadth to condylo-basal length 62-64) *oxytona* (p. 63).
- a'. Upperparts mainly brownish, yellowish, drab, or buffy.
- b. Upperparts of solid colors (not grizzled).
- c. Upperparts brownish drab, buffy, or russet. *olympus* (p. 69).
- c'. Upperparts dark vandyke brown, blackish brown, or black.
- d. Posterior border of nasals deeply emarginate; color dark vandyke brown. *vancouverensis* (p. 70).
- d'. Posterior border of nasals not deeply emarginate; color blackish brown or black. *vigilis* (p. 61).
- b'. Upperparts of mixed colors (grizzled).
- c. Sides of neck with conspicuous buffy patches.
- d. Underparts distinctly reddish.
- e. Crown chestnut. *warreni* (p. 52).
- e'. Crown blackish brown.
- f. Long hairs on fore back with a subterminal band of black or brown. *nosophora* (p. 46).
- f'. Long hairs on fore back without a subterminal band of black or brown. *dacota* (p. 49).
- d'. Underparts not distinctly reddish.
- e. Size smaller; condylo-basal length of ♀ skull 71-80 mm.; of ♂ skull 85-87.¹
- f. Fore back with a distinct buffy mantle.
- g. Underparts darker; size smaller. *parvula* (p. 44).
- g'. Underparts paler; size larger. *avara* (p. 41).
- f'. Fore back without a distinct buffy mantle. *engelhardti* (p. 45).
- e'. Size larger; condylo-basal length of ♀ skull 77-90 mm.; of ♂ skull 84-97 mm.
- f. Face markings and neck patches reduced. *obscura* (p. 53).
- f'. Face markings and neck patches prominent.
- g. Hind feet darker (hazel or chestnut-brown) *luteola* (p. 50).
- g'. Hind feet lighter (tawny to light buff).
- h. Larger; condylo-basal length of ♂ skull more than 90 mm.; of ♀ more than 84 mm. *flaviventris* (p. 39).
- h'. Smaller; condylo-basal length of ♂ skull less than 90 mm.; of ♀ less than 84 mm. *sierrae* (p. 43).

¹ Adult male of *parvula* and *engelhardti* unknown.

- c'*. Sides of neck without conspicuous buffy patches.
- d*. Tail cinnamon.....*ochracea* (p. 34).
- d'*. Tail dark brown or black.
- e*. Colors pale (underfur on back light pinkish cinnamon to light gray at tips; belly not deep red).
- f*. Skull larger; condylo-basal length more than 90 mm.....*monax* (p. 22).
- f'*. Skull smaller; condylo-basal length less than 90 mm.....*preblorum* (p. 27).
- e'*. Colors dark (underfur on back pinkish cinnamon to orange-cinnamon at tips; belly deep red).
- f*. Size smaller; condylo-basal length of ♂ skull less than 82 mm.; of ♀ less than 80 mm.....*canadensis* (p. 30).
- f'*. Size larger; condylo-basal length of ♂ skull more than 82 mm.; of ♀ more than 80 mm.
- g*. Nasals relatively short and wide; width at posterior end in males more than 11 mm.....*ignava* (p. 29).
- g'*. Nasals relatively long and narrow; width at posterior end in males less than 11 mm.
- h*. Size larger; nasals longer, extending considerably back of posterior end of premaxillae.....*rufescens* (p. 25).
- h'*. Size smaller; nasals shorter, extending little, if any, back of posterior end of premaxillae.....*petrensis* (p. 33).

DESCRIPTIONS OF AMERICAN SPECIES AND SUBSPECIES.

Marmota monax Group.

[Characters under species.]

MARMOTA MONAX (LINNAEUS).

[Synonymy under subspecies.]

External characters.—Size medium;¹ tail relatively short (about 20 to 25 per cent of total length); ears large; posterior pad on sole of hind foot oval in shape and situated near middle of sole (see Pl. III, fig. 3); mammae—P. $\frac{2}{2}$, A. $\frac{1}{1}$, I. $\frac{1}{1}$ =8; head without white markings (except around nose); sides of neck same color as upperparts; feet black or dark brown; fore legs overlaid with deep reddish-colored hairs (hazel to burnt sienna); tail black, dark brown, or (in *ochracea*) pinkish cinnamon.

Cranial characters.—Skull with superior outline nearly straight, the occipital region slightly depressed and rostrum considerably but not abruptly depressed from about posterior border of premaxillae; brain-case broad and noticeably flattened; interorbital region relatively broad; postorbital processes heavy, projecting nearly at right angles to axis of skull or slightly forward; width of nasals at posterior end usually decidedly greater than width of nasal branches of premaxillae; temporal ridges often not meeting in old age, or sometimes meeting but not united (rarely fused into a sagittal crest); floor of basi-occipital nearly flat, bordered on each side by low processes which converge posteriorly and sometimes meet near inferior lip of foramen magnum;

¹Audubon and Bachman give the weight of one as 9 pounds 11 ounces; a writer in *Forest and Stream*, LV, p. 424, gives the average weight of 158 as 10 pounds; heaviest, 13½ pounds.

palate abruptly truncate at posterior border; interpterygoid fossa relatively wide; palatal foramina contracted anteriorly; molar teeth heavy; maxillary tooth rows approximately parallel; anterior face of incisors yellowish white or ivory yellow to pale orange-yellow.

Color.—General tone of upperparts grayish- or reddish-brown, or (in *ochracea*) vinaceous-cinnamon, grizzled with white, light buff, or cinnamon-buff; underfur of upperparts at base dark mouse gray to blackish brown, succeeded by pallid neutral gray, light ochraceous-buff, pinkish-, vinaceous-, or orange-cinnamon; long hairs dark chestnut-brown, blackish brown, or (in *ochracea*) orange-cinnamon, tipped with light buff, pale ochraceous-buff, or white; top of head and face varying from dark hair-brown or benzo brown to vandyke- or clove-brown; sides of face light buff, ochraceous-buff, or white, mixed with brown; borders of nose, lips, and chin, white or buffy white; underparts buffy white, light ochraceous-buff, pinkish cinnamon, tawny, hazel, or burnt sienna, more or less varied with brown, the bases of hairs often blackish brown or black; fore legs and feet black, blackish brown, dark chestnut-brown, fuscous, or hazel (in *ochracea*), the legs and thighs (except in *ochracea*) overlaid with burnt sienna, Sanford's brown, or tawny; hind legs and feet similar, but thighs often paler, sometimes overlaid with pinkish cinnamon; tail black or blackish brown, vandyke- or clove-brown, or (in *ochracea*) pinkish cinnamon, more or less grizzled with buffy white or cinnamon-buff; ears drab-gray on both surfaces, often clothed with fuscous hairs.

Geographic distribution.—From eastern Alaska (Fortymile Creek), Great Slave Lake, York Factory (Hudson Bay), East Main and Hamilton Rivers, Quebec, south to northern Idaho in the Rocky Mountains, and east of the Great Plains to northern Arkansas, northern Alabama, and southern Virginia; west in the United States to eastern parts of North Dakota, Kansas, and Oklahoma. (See fig. 1.)

MARMOTA MONAX MONAX (LINNAEUS).

SOUTHERN WOODCHUCK.

(Pl. IV, fig. 2; Pl. V, fig. 1; Pl. XI, fig. 1.)

[*Mus*] *monax* Linnaeus, Syst. Nat., ed. 10, I, 1758, p. 60.

[*Glis*] *monax* Erxleben, Syst. Regn. Anim., 1777, p. 361.

Arctomys monax Schreber, Säugthiere, IV, 737, 1782; Plate CCVIII, 1780.

[*Marmota*] *monax* Trouessart, Cat. Mamm., Suppl., 1904, p. 344.

Type locality.—Maryland.

Distribution.—Middle eastern United States from Pennsylvania, New Jersey (?), Ohio, Indiana, Illinois, and Iowa, south to the northern parts of South Carolina, Georgia, Alabama, and Arkansas; west to eastern Kansas.

Characters.—Size large; colors pale, the underfur grayish white; underparts little, if any, darker than upperparts; skull massive.

Color.—General tone grayish brown above, with a faint buffy tinge; underfur blackish brown at base succeeded by pallid neutral gray, faintly (rarely strongly) tinged with light ochraceous-buff, strongest on hinder back; long hairs blackish brown, broadly tipped with white



FIG. 1.—Distribution of the *Marmota monax* group. Unshaded areas within the range of the group indicate lack of definite knowledge as to the subspecies occurring there.

or buffy white; top of head and face varying from benzo brown to clove brown; sides of nose and borders of lips and chin buffy white; sides of face mixed brown and buffy white; feet and legs black or blackish brown (rarely fuscous or dark chestnut-brown), the hairs on legs tipped with tawny or hazel; tail blackish brown, sparingly

grizzled with buffy white; underparts buffy white or light ochraceous-buff, the bases of hairs blackish brown.

Skull.—Largest of the group; relatively long and narrow; sagittal crest well developed (in adults); interorbital region broad; nasals long and broad, usually squarely truncated posteriorly; premaxillae narrow; palate long, extending from 2 to 4 mm. behind plane of molars; palatal foramina rather narrow; interpterygoid fossa broad; audital bullae moderately inflated.

Measurements.—Adult male from Gunston, Va: Total length, 665; tail vertebrae, 153; hind foot, 88. Adult male from Sandy Spring, Md.: 573; 145; 82. Average of 4 adult females from District of Columbia and Virginia: 557; 139; 83. *Skull*: Adult male:¹ Condylobasal length, 97.3–102.5 (average 97.8); palatal length, 55–59.5 (57.4); postpalatal length, 34.5–37.7 (36.2); length of nasals, 39.7–41.8 (40.8); zygomatic breadth, 63–69.2 (65.9); breadth across mastoids, 44.5–50.2 (46.9); least interorbital breadth, 25–29.2 (27.1); breadth of rostrum, 20.6–23.7 (21.7); maxillary tooth row, 21–21.9 (21.3). Adult female:² Condylobasal length, 90.4–91.8 (91.2); palatal length 50.2–56 (53.1); postpalatal length, 33.7–36.3 (34.9); length of nasals, 36.8–40.6 (38.7); zygomatic breadth, 59.5–62 (61.2); breadth across mastoids, 44–45.8 (44.7); least interorbital breadth, 23.5–26.5 (24.9); breadth of rostrum, 19.7–21.3 (20.5); maxillary tooth row, 20.5–22.4 (21.2).

Remarks.—The southern woodchuck is a rather large animal of massive skull and pale color. With a wide range in the Middle States, it grades into a smaller and darker form (*rufescens*) in the southern parts of New York, Michigan, and Wisconsin. Specimens from northern Illinois (Lake Forest and Willow Springs) and northern Indiana (Rose Lawn and Lake Maxinkuckee) are typical of *monax*, but those from Delavan, Wis., and southwestern Michigan are intermediate between *monax* and *rufescens*. Specimens from Marble Cave, Mo., and from Johnson County, Iowa, are typical, but a small series from the vicinity of Lawrence, Kans., seems to indicate the presence there of a large form, skulls of females, especially, being much larger than those of females from Maryland and Virginia and equaling in size skulls of males from that region. The hind feet also average about 16 per cent longer in the Kansas animal (3 specimens). Additional material from that region may require naming the form.

Specimens examined.—Total number, 75, as follows:

Alabama: Ardell, 3.

District of Columbia: Washington, 6.

Georgia: Young Harris, 1.

¹ Six specimens from Maryland, Virginia, West Virginia, and Pennsylvania.

² Five specimens from Virginia, District of Columbia, and Pennsylvania.

- Illinois:** Cook County, 1; Lake Forest, 1;¹ Ozark, 2;¹ West Northfield, 1; Willow Springs, 1.¹
- Indiana:** Lake Maxinkuckee, 1; Marion County, 1;² Rose Lawn, 1.
- Iowa:** Iowa City, 4;³ Johnson County, 4;³ Wall Lake, 1; no specific locality, 3.³
- Kansas:** Douglas County (near Lawrence), 6;⁴ Lawrence, 3.⁴
- Kentucky:** Mammoth Cave, 1.
- Maryland:** Plummer Island, 2; Sandy Spring, 1; Simpsonville, 1; near Washington, D. C., 1.
- Michigan:** Cass County, 1;⁵ Dowagiac, 1.⁵
- Missouri:** Marble Cave, 2.
- North Carolina:** Magnetic City (base of Roan Mountain), 7; Roan Mountain (altitude 3,000-4,000 feet), 5.
- Ohio:** Hicksville, 1.¹
- Pennsylvania:** Beaver, 2;⁶ Chester County, 3; Fair Oaks, 1;⁶ Kennett Square, 1;⁷ Landenberg, 1;⁷ Marple, 1;⁷ Meadville, 1; Round Island, Clinton County, 2.⁷
- Tennessee:** Dover, Stewart County, 1; Duck River, 6 miles southwest of Waverly, 2; Highcliff, 1.
- Virginia:** Bluemont, 1; Clarke County, 1; Doswell, 1; Fairfax County (Potomac River), 3; Fincastle, 1; Fredericksburg, 2; Gunston, 1; Peaks of Otter, 1; Washington, 2.
- West Virginia:** Franklin, 3; Jobs Knob, 1; North Mountain, Hardy County, 1; Rowleysburg, 1.

MARMOTA MONAX RUFESCENS HOWELL.

RUFESCENT WOODCHUCK.

(Pl. IV, fig. 5; Pl. V, fig. 2; Pl. XI, fig. 2.)

Marmota monax rufescens Howell, Proc. Biol. Soc. Washington, XXVII, 1914, p. 13.*Type locality.*—Elk River, Minn.*Distribution.*—Eastern North Dakota, central and southern Minnesota, Wisconsin, and Michigan, southern Ontario, greater part of New York (including Long Island), and higher parts of western Massachusetts.*Characters.*—Similar to *monax* but colors much redder, both above and below, the underfur on back pinkish cinnamon instead of light buff; similar in color to *ignava*, but averaging paler; skull decidedly smaller than that of *monax*, but much larger than that of *canadensis*.*Color.*—Underfur of upperparts varying from fuscous-black to dark mouse gray at base, succeeded by a broad area of light pinkish cinnamon shading to pinkish cinnamon on hinder back and to orange-cinnamon on hind legs; long hairs dark chestnut-brown subterminally, tipped with light buff; top of head and face benzo brown to clove brown; sides of face light buff, more or less mixed with brown; fore legs black, overlaid with burnt sienna; hind legs similar but usually less intensely red; feet black or blackish brown; tail vandyke brown¹ Collection Field Mus. Nat. Hist.² Collection Amer. Mus. Nat. Hist.³ Collection Univ. of Iowa.⁴ Collection Kansas Univ. Mus.⁵ Collection Univ. of Michigan.⁶ Collection Carnegie Museum.⁷ Collection Acad. Nat. Sci. Philadelphia.

to clove brown or black; underparts varying from burnt sienna to Sanford's brown, more or less mixed with tawny, ochraceous-buff, and black (general tone of under parts usually reddish but sometimes mixed brown and buff with little red); tail vandyke brown to clove brown or black. *Variation*: Specimen from Essex County, N. Y.: Very dark chestnut-brown above (the underfur pinkish cinnamon), moderately grizzled on fore back with buffy white; hinder back solid brown.

Skull.—Similar to that of *monax*, but decidedly smaller and relatively broader across zygomata; much larger than that of *canadensis*; slightly larger than that of *ignava*, but narrower across orbits and with narrower nasals.

Measurements.—Adult male:¹ Total length, 520–582 (average, 548); tail vertebrae, 135–155 (143); hind foot, 81–85 (83). Adult female:² Total length, 545–608 (571); tail vertebrae, 145–170 (156); hind foot, 83–89 (85). *Skull*: Adult male:³ Condylar-basal length, 81.3–94.4 (88.6); palatal length, 50.7–54.5 (51.8); postpalatal length, 32–36.4 (33.5); length of nasals, 33.9–39.8 (36.8); zygomatic breadth, 53.4–64.7 (60.2); breadth across mastoids, 40.3–46 (43.2); least interorbital breadth, 21.7–25.4 (23.8); breadth of rostrum, 18–21.2 (19.4); maxillary tooth row, 18.7–21.8 (20.1). Adult female:⁴ Condylar-basal length, 84–88.9 (85.8); palatal length, 49.1–52.4 (50.6); postpalatal length, 31.5–31.8 (31.6); length of nasals, 33.4–39.1 (35.6); zygomatic breadth, 57.5–62 (59.9); breadth across mastoids, 40.6–43.8 (42.4); least interorbital breadth, 22.2–26.3 (23.6); breadth of rostrum, 18.2–20.4 (19); maxillary tooth row, 17.5–21 (19.7).

Remarks.—The woodchucks of the Northern States, from Minnesota to New York, differ from typical *monax* of the Middle States in having smaller skulls and darker colors, the underfur especially being more strongly reddish. The race shows a strong tendency toward melanism, particularly in New York and southern Ontario. The New York series differs from the Minnesota series in somewhat longer and relatively narrower skulls, being, therefore, more like *monax*, but the differences between the two extremes are too slight and inconstant to warrant recognition of another form. Specimens from the Catskill Mountains are fairly typical of *rufescens*, but those from the Hudson Valley and Lake George are clearly intermediate, the skulls being almost typical of *monax* and the skins of *rufescens*. These show no approach to the New England form (*prebolorum*). Two skulls (without skins) from Easthampton, Mass., are fairly typical of *rufescens*, indicating that this race probably occupies the higher parts of western Massachusetts. A specimen from Lake of Bays, Ontario (east side of Georgian Bay), considered intermediate between *rufescens* and *canadensis*, is very deep red below—fully

¹ Five specimens from Elk River and Fort Snelling, Minn.

² Five specimens from Fort Snelling, Minn.

³ Eleven specimens from Minnesota.

⁴ Five specimens from Minnesota.

as dark as *ignava*. The northern limit of the range of *rufescens* is assumed to be about the latitude of Ottawa, but no material is available from that part of Ontario, excepting the specimen mentioned above.

Specimens examined.—Total number, 231, as follows:

Massachusetts: Easthampton, 2.

Michigan: Ann Arbor, 3;¹ Au Sable River, Oscoda County, 1;¹ Genesee, 1; Rush Lake, Huron County, 1; ¹ Sand Point, Huron County, 1.¹

Minnesota: Elk River, 10; Fort Snelling, 17;² Princeton, 1.

New York: Adirondack Mountains, Essex County, 76 (skulls only); Ardsley, 1;³ Amber, 2; Brantingham, 1; Croton Lake, 1; Dutchess County, 1;³ Elizabethtown, 2; Essex County, 8; Halcottsville, 10;⁴ Hastings, 1;⁵ Highland Falls, 1; Lake George, 11; Leyden, 2; Locust Grove, 15; Lyons Falls, 5; Miller Place, 4;⁴ Orange County, 1; Owego, 1; Oyster Bay, 2; Peterboro, 4; Piseco, 1; Schroon, 1; Schroon Lake, 4; Sing Sing, 4; Suffolk County, 2;^{3,5} Troy, 3; Tupper Lake, 1;⁶ Wells, 3; no specific locality, 7.

North Dakota: Fargo, 3;⁷ Grafton, 1; Leonard, 1.⁸

Ontario: Lake of Bays, 1; Lorne Park, 7.

Wisconsin: Bridgeport, 1; Delavan, 2; Milton, 2;⁹ Racine, 1.

MARMOTA MONAX PREBLORUM HOWELL.

NEW ENGLAND WOODCHUCK.

(Pl. III, fig. 3; Pl. V, fig. 3; Pl. XI, fig. 3.)

Marmota monax preblorum Howell, Proc. Biol. Soc. Washington, XXVII, 1914, p. 14.

Type locality.—Wilmington, Mass.

Distribution.—Southern New England, from Connecticut to central Vermont and New Hampshire and southern Maine.

Characters.—Size medium (smaller than *rufescens*, larger than *canadensis*); colors pale (redder than *monax*, but red not so dark as in *canadensis* or *rufescens*); skull smaller and relatively narrower than that of *rufescens*.

Color.—*Adult*: Underfur on upperparts pinkish cinnamon to light pinkish cinnamon, the bases of hairs fuscous-black; long hairs blackish brown, extensively tipped with white or light buff; top of head and face dark hair-brown to clove brown; sides of face light buff; fore legs burnt sienna or Sanford's brown, the bases of hairs often black; hind legs somewhat paler, shading to pinkish cinnamon; feet black or blackish brown; tail clove brown to black, much mixed with cinnamon; underparts pinkish cinnamon or Sanford's brown, varied with light buff. *Young* (specimen from Saun-

¹ Collection Univ. of Michigan.

² Three in collection Field Mus. Nat. Hist.; five in Amer. Mus. Nat. Hist.

³ Collection Amer. Mus. Nat. Hist.

⁴ Collection A. H. Helme, Miller Place, N. Y.

⁵ Collection Field Mus. Nat. Hist.

⁶ Collection Mus. Comp. Zool.

⁷ Two in collection Fargo College; one in N. Dak. Agr. College.

⁸ Collection N. Dak. Agr. College.

⁹ Collection H. H. T. Jackson, Washington, D. C.

derstown, R. I.): General tone, both above and below, pinkish buff (the hairs extensively tipped with that color and the bases of same shade), becoming pinkish cinnamon on hinder back; subterminal band of each hair blackish brown; fore legs Sanford's brown; hind legs tawny; top of head hair-brown.

Skull.—Similar to that of *rufescens*, but smaller and relatively narrower, especially the rostrum and interorbital region; bullae smaller; much larger than that of *canadensis*, with longer, slenderer rostrum and longer nasals.

Measurements.—Adult male:¹ Total length, 418–608 (average 515); tail vertebrae, 105–149 (120); hind foot, 75–80 (77.7). Adult female:² 465–600 (547); 100–157 (141); 69–88 (77). *Skull*: Adult male:³ Condyllo-basal length, 84–89 (86.2); palatal length, 49.9–51.6 (50.7); postpalatal length, 31.2–33.4 (32); length of nasals, 34.3–37.7 (35.9); zygomatic breadth, 57.3–60.4 (58.7); breadth across mastoids, 41.3–44.3 (42.8); least interorbital breadth, 20.7–22.5 (22.1); breadth of rostrum, 17.2–18.6 (18.2); maxillary tooth row, 18.2–20.2 (19.1). Adult female:⁴ Condyllo-basal length, 79.1–86.6 (83); palatal length, 47.7–51.6 (49.5); postpalatal length, 28–31.8 (30.1); length of nasals, 33.7–36.8 (35.6); zygomatic breadth 54–58 (56.6); breadth across mastoids, 37.7–42 (40.3); least interorbital breadth, 19.8–22.6 (21.6); breadth of rostrum, 16–19.5 (18); maxillary tooth row, 18–20.4 (19.3).

Remarks.—The New England woodchuck is noticeably smaller and paler than *rufescens*, and larger and paler beneath than *canadensis*. In skull characters it most resembles *rufescens* and probably intergrades with it where their ranges meet, but no intermediate specimens have been examined. A specimen from Liberty Hill, Conn., has somewhat redder underparts than the Massachusetts series, its skull being fairly typical of *preblorum*. Specimens of *rufescens* from the Hudson Valley, however, approach *monax* rather than *preblorum* in skull characters. Intergradation with *canadensis* also undoubtedly occurs, but material from northern New England is needed to show where the two forms come together. Specimens from Rutland, Vt., agree in skull characters with *preblorum*, but one of the two skins examined is somewhat redder below than in Massachusetts examples.

Specimens examined.—Total number, 38, as follows:

Connecticut: East Wallingford, 1;⁵ Liberty Hill, 1.⁶

Maine: Eliot, 1; Norway, 1.⁶

¹ Seven specimens from eastern Massachusetts.

² Nine specimens from eastern Massachusetts and southern New Hampshire.

³ Five specimens from Wilmington and Wareham, Mass.

⁴ Four specimens from Wilmington and Lunenburg, Mass.

⁵ Collection Am. Mus. Nat. Hist.

⁶ Collection Mus. Comp. Zool.

Massachusetts: Essex County, 1; Haverhill, 1;¹ Lunenburg, 4; Newtonville, 2;¹ Sherborn, 1; Springfield, 2;¹ Wareham, 2;¹ Wayland, 1;¹ Wilmington, 8; Woburn, 1.

New Hampshire: Charlestown, 2; Ossipee, 2; Webster, 3.¹

Rhode Island: Saunterstown, 1.

Vermont: Rutland, 3.²

MARMOTA MONAX IGNAVA (BANGS).

LABRADOR WOODCHUCK.

(Pl. V, fig. 4; Pl. XII, fig. 1.)

Arctomys ignavus Bangs, Proc. New England Zool. Club, I, 1899, p. 13.

[*Arctomys monax*] *ignavus* Elliot, Synop. Mamm. N. Am., Field Columb. Mus., Zool. Ser., II, 1901, p. 105.

[*Marmota monax*] *ignavus* Trouessart, Cat. Mamm., Suppl., 1904, p. 344.

Marmota ignava Miller, Bul. 79, U. S. Nat. Mus., 1912, p. 292.

Type locality.—Black Bay, Straits of Belle Isle, Labrador.

Distribution.—Known only from vicinity of type locality; probably north to Hamilton Inlet.

Characters.—Size much larger than *canadensis*, nearly equaling *rufescens*; similar in color to *rufescens* (much darker than *canadensis*); skull short and broad with very broad nasals.

Color.—Underfur of upperparts blackish brown at base (a shade darker than in *canadensis*), succeeded by a broad area of orange-cinnamon; long hairs blackish brown subterminally, tipped with pale ochraceous-buff or buffy white; top of head and face vandyke brown or clove brown; sides of nose and borders of lips and chin buffy white; sides of face light ochraceous-buff more or less mixed with brown; feet and legs black, or very dark brown, the legs and thighs overlaid with burnt sienna; tail blackish brown, usually with little or no white grizzling; underparts burnt sienna mixed with black, varying to tawny and in some individuals more or less mixed with pinkish cinnamon or pale buff; in others, mixed blackish brown and buff below without any red.

Skull.—Similar to that of *rufescens*, but shorter and relatively broader; nasals shorter and relatively wider posteriorly; premaxillae averaging narrower; bullae smaller and less inflated; sagittal crest more prominent; incisors with numerous shallow longitudinal grooves on outer face. Compared with *preblorum*: Skull about same length, but relatively broader; rostrum broader; nasals shorter and broader posteriorly; molars heavier. Compared with *canadensis*: Skull much larger, with decidedly heavier sagittal crest and less inflated bullae.

Measurements.—Adult male:³ Total length, 480–562 (average, 536); tail vertebrae, 111–155 (137); hind foot, 74–86 (80.8). Adult

¹ Collection Mus. Comp. Zool.

² Collection Amer. Mus. Nat. Hist.

³ Seven specimens from vicinity of type locality.

female:¹ 496–556 (528); 102–147 (126); 75–80 (78.6). *Skull*: Adult male:¹ Condyllo-basal length, 82.5–87.4 (85.1); palatal length, 48.5–51.2 (50); postpalatal length, 30.6–33 (31.7); length of nasals, 31.5–35.6 (34.1); zygomatic breadth, 57.5–63.4 (60.5); breadth across mastoids, 40.6–44 (41.7); least interorbital breadth, 24–26.8 (25); breadth of rostrum, 18–20.3 (19.2); maxillary tooth row, 19.9–20.8 (20.4). Adult female:¹ Condyllo-basal length, 79.7–84.4 (82.2); palatal length, 47–49.4 (48.2); postpalatal length, 29.2–31.7 (30.6); length of nasals, 31.3–34.2 (32.6); zygomatic breadth, 55.4–58.7 (57.1); breadth across mastoids, 39–41.5 (40.6); least interorbital breadth, 22.5–25 (23.8); breadth of rostrum, 17.6–19.7 (18.7); maxillary tooth row, 19–20.4 (19.9).

Remarks.—The Labrador woodchuck is a strongly marked form of the *monax* group, much larger and darker than *canadensis*, its nearest neighbor. Indeed, it might be considered a distinct species were it not practically certain that the ranges of *ignava* and *canadensis* are contiguous and that more material from the region between Murray Bay and the Straits of Belle Isle would show intergradation. In color and size the present form more closely resembles *rufescens* than *canadensis* and the skull is more like that of *prebblorum* than that of any other form, but *ignava* is much darker than *prebblorum*. The subspecies is reported to be common on the coast in the vicinity of Black Bay, and is said to be found about the head of Hamilton Inlet,² but the limits of its range are not known. Stearns reports woodchucks “common at Mingan, growing scarce toward Bonne Esperance.”³

Specimens examined.—Total number, 15, as follows:

Labrador:⁴ Ailik, Peter's Cove, 1; Black Bay, 4; L'Anse au Loup, 10.

MARMOTA MONAX CANADENSIS (ERXLEBEN).

CANADA WOODCHUCK.

(Pl. VI, fig. 1; Pl. XI, fig. 4.)

[*Glis*] *canadensis* Erxleben, Syst. Regn. Anim., 1777, p. 363.

Mus empetra Pallas, Nov. Spec. Quad., Glir. Ord., 1778, p. 75.

Arctomys sibila Wolf, Linne's Natursyst., II, 1808, p. 481. (Name proposed to include

Arctomys empetra Pallas and *Arctomys pruinosus* Gmelin, supposed to be the same).

Arctomys melanopus Kuhl, Beiträge, 1820, p. 64.

Arctomys marmota canadensis Kuhl, Beiträge, 1820, p. 64.

Arctomys empetra Sabine, Trans. Linn. Soc. London, XIII, 1822, p. 584; Richardson, Fauna Boreali-Americana, I, 1829, p. 147.

Arctomys monax melanopus Rhoads, Proc. Acad. Nat. Sci. Philadelphia, 1897, p. 30.

Arctomys monax canadensis Allen, Bul. Amer. Mus. Nat. Hist., X, 1898, p. 456.

[*Marmota monax*] *canadensis* Trouessart, Cat. Mamm., Suppl., 1904, p. 344.

¹ Six specimens from vicinity of type locality.

² Low, A. P. Ann. Rept. Geol. Surv. Canada, VIII, 1895 (1897), p. 320L.

³ Stearns, W. A. Proc. U. S. Nat. Mus., VI, 1883, p. 115.

⁴ All in collection Mus. Comp. Zool.

Type locality.—"Canada et ad fretum Hudsonis"—here fixed at Quebec, Quebec.

Distribution.—Greater part of interior of Canada, from Great Slave Lake and York Factory south to southern Alberta (Red Deer), central Saskatchewan (Cumberland House), northern Minnesota, northern Wisconsin, northern Michigan, central Ontario, southern Quebec, New Brunswick, and Nova Scotia; northern and eastern limits of range in Quebec unknown.

Characters.—Size small; sexes about same size; colors strongly reddish, above and below; skull small without pronounced sagittal crest.

Color.—Underfur on upperparts blackish brown at base, succeeded by pinkish cinnamon or light pinkish cinnamon; long hairs blackish brown subterminally, tipped with white or pinkish buff; top of head and face hair-brown, sometimes shading to clove brown; sides of face light buff; feet and legs black, blackish brown, or fuscous, the legs and thighs overlaid with burnt sienna; tail blackish brown, considerably grizzled with cinnamon-buff or light buff; underparts deep tawny or burnt sienna sometimes varied with buff and moderately mixed with black. Melanistic specimens are rarely found, but one from Aitkin, Minn., is glossy blackish brown all over.

Skull.—Smallest of any member of the group; shorter and relatively broader than that of *prebolorum*, with short, broad rostrum; much smaller than that of *ignava*, with sagittal crest only slightly developed; nasals narrowed posteriorly; bullae relatively large, smoothly rounded, and considerably inflated.

Measurements.—Adult male: Total length, 510–515 (average 513); tail vertebrae, 108–109 (108.5); hind foot, 74–78 (76);¹ average of three adult males from Mackenzie and Alberta: 500; 124; 75. Adult female:² 508–560 (536); 131–140 (136); 69–76 (73). *Skull:* Adult male:³ Condyllo-basal length, 75–80.8 (78.1); palatal length, 43.7–48.2 (45.7); postpalatal length, 27.5–29.6 (28.7); length of nasals, 29.9–32 (31.3); zygomatic breadth, 53–56.6 (54.1); breadth across mastoids, 36.4–39.4 (38); least interorbital breadth, 18.4–22.7 (20.7); breadth of rostrum, 15.1–18 (16.6); maxillary tooth row, 18.2–19.3 (18.8). Adult female:⁴ Condyllo-basal length, 77.4–80 (78.9); palatal length 45.6–47.2 (46.2); postpalatal length, 28.2–30.5 (29.3); length of nasals, 30.5–34.5 (32.6); zygomatic breadth, 52.8–58.2 (54.8); breadth across mastoids, 36.5–39.8 (37.8); least interorbital breadth, 19.8–22 (20.9); breadth of rostrum, 14.5–17.8 (16.3); maxillary tooth row, 18.1–19.2 (18.6).

Remarks.—The Canada woodchuck has the most extensive distribution of any of the American forms and over the greater part of

¹ Two specimens from Murray Bay, Quebec.

² Three specimens from Quebec and Ontario.

³ Eight specimens from Mackenzie, Alberta, Manitoba, Quebec, Nova Scotia, and northern Wisconsin.

⁴ Seven specimens from Mackenzie, Manitoba, Ontario, Nova Scotia, and Quebec.

its range shows comparatively little variation. Although markedly smaller than *rufescens* it intergrades with that form wherever their ranges meet, intermediate examples having been examined from Tower and Two Harbors, Minn., and Lake of Bays, Ontario. Intergradation with *ignava* seems highly probable, though not shown by the material in hand. Murray Bay specimens have very much smaller skulls than typical *ignava* from the Labrador coast, and no specimens have been examined from the intervening region. Two specimens from Nova Scotia show slight approach to *ignava*, the skins being the same color except that the bases of the hairs on the back are browner. The skull of one of these specimens is typical of *canadensis*, the other is a little larger, with somewhat broader nasals and a well-marked sagittal crest.

A specimen from Porcupine Mountains, Mich., resembles *canadensis* in general coloration, but is extensively mixed with black both above and below. Its skull is slightly longer than skulls of typical specimens from Quebec. A specimen from Mount Mansfield, Vt., and one from Columbia Falls, Me., (both without skulls), are provisionally referred to *canadensis*, the former agreeing in color with the typical form, the latter with the dark Nova Scotia form. Specimens from southern Mackenzie and northern Alberta are practically identical in coloration with the Quebec series, but their skulls average longer and narrower, thus showing approach to *ochracea*. A single young specimen in very worn pelage from near the head of Finlay River, British Columbia, seems referable to *canadensis*, but more material from that region may necessitate its reference to *ochracea*. Woodchucks of this group are reported by Edward A. Preble as occurring at Fort Grahame, on Finlay River, and at Hudson's Hope.

Specimens examined.—Total number, 45, as follows:

Alberta: Athabaska River (near Fort McMurray), 1; McLeod River, 1; Peace River Landing, 2;¹ Red Deer, 1;² South Edmonton, 1.

British Columbia: Finlay River (near head), 1.

Mackenzie: Fort Liard, 1; Fort Simpson, 5; Little Buffalo River, 1.

Maine: Columbia Falls, 1.

Manitoba: Oxford House, 1; Trout Lake, 4; York Factory, 1.

Michigan: Porcupine Mountains, 1;³ Whitefish Point, Chippewa County, 1.³

Minnesota: Aitkin, 1;² Tower, 1; Two Harbors, 1.

New Brunswick: Arthurette, 2;⁴ Scotch Lake, 1.

North Dakota: Pembina, 1.

Nova Scotia: Newport, 2.⁴

Ontario: Devils Portage, Mattagami River, 1;⁵ James Bay, 1; Moose River (near Hudson Bay) 2.⁴

Quebec: Murray Bay, 7.²

Vermont: Mount Mansfield, 1.

Wisconsin: Conover, 1.²

¹ Collection Victoria Mem. Mus.

² Collection Field Mus. Nat. Hist.

³ Collection Univ. of Michigan.

⁴ Collection Amer. Mus. Nat. Hist.

⁵ Collection Carnegie Mus.

MARMOTA MONAX PETRENSIS SUBSP. NOV.

BRITISH COLUMBIA WOODCHUCK.

(Pl. VI, fig. 2.)

Type from Revelstoke, British Columbia. Adult ♂, No. 203532, U. S. Nat. Mus., Biological Survey collection. Collected May 12, 1890, by W. Spreadborough; original number, 170.

Distribution.—Interior ranges of southern British Columbia and adjacent parts of United States, from Barkerville, British Columbia, south to Thompson Pass, Idaho.

Characters.—Similar to *canadensis*, but skull larger and relatively longer.

Color.—Practically the same as *canadensis*.

Skull.—Similar to that of *canadensis*, but larger and relatively longer; nasals rather short, projecting but little back of posterior ends of premaxillae; bullae rather small. Compared with *rufescens*: Smaller with shorter nasals and smaller, rounder bullae.

Measurements.—Adult male (type):¹ Total length, 540; tail vertebrae, 127; hind foot, 76; specimen from Barkerville, British Columbia: 460; 106; 72. Adult female (specimen from Barkerville, British Columbia): 505; 125; 68. *Skull*: Adult male (type): Condyllo-basal length, 86; palatal length, 50.3; postpalatal length, 31.8; length of nasals, 32.5; zygomatic breadth, 57.4; breadth across mastoids, 42; least interorbital breadth, 23; breadth of rostrum, 18.6; maxillary tooth row, 20. Adult female (specimen from Barkerville, British Columbia): Condyllo-basal length, 79; palatal length, 46.5; postpalatal length, 29.5; length of nasals, 32.4; zygomatic breadth, 53.2; breadth across mastoids, 36; least interorbital breadth, 19.4; breadth of rostrum, 17.6; maxillary tooth row, 18.8.

Remarks.—This is a slightly differentiated form of *monax*, occupying an area somewhat segregated from the rest of the species. It is known at present from only a few specimens and the limits of its range can not definitely be determined. It probably occurs sparingly throughout the heavily timbered mountain sides of the northern Rocky Mountains in Montana, Idaho, and British Columbia, but whether confined entirely to the west slope or not (as seems probable) has not yet been ascertained. This subspecies has no direct connection with *monax* or *rufescens*, its range being separated from theirs by an extensive area of plains, but it undoubtedly intergrades with *ochracea* on the north and possibly with *canadensis* through some of the passes of the mountains in southern British Columbia.

Specimens examined.—Total number, 6, as follows:

British Columbia: Barkerville, 2; Glacier, 2; Revelstoke, 1.

Idaho: Thompson Pass, 1.

¹ From dry skin.

MARMOTA MONAX OCHRACEA SWARTH.

OCHRACEOUS WOODCHUCK.

(Pl. VI, fig. 3; Pl. XII, fig. 3.)

Marmota ochracea Swarth, Univ. of California Pub. Zool., VII, 1911, p. 203.*Type locality*.—Head of Fortymile Creek, Alaska.*Distribution*.—Interior mountain ranges of Yukon and northern British Columbia, from Fortymile Creek south to the Babine Mountains (and Stuart Lake?).*Characters*.—Similar to *canadensis*, but paler below and hairs on back extensively tipped with ochraceous, the underfur more vinaceous; tail pinkish cinnamon all around; skull longer and relatively narrower.*Color*.—Underfur of upperparts dark mouse gray at base, succeeded by a broad area of vinaceous-cinnamon, the latter shading toward the tips into orange-cinnamon, most intense on hinder back; long hairs orange-cinnamon, then blackish brown, broadly tipped on fore back with ochraceous-buff and on hinder back with light ochraceous-buff; top of head dark hair-brown; sides of nose and face light ochraceous-buff; underparts tawny shading to hazel; legs hazel; feet fuscous or fuscous-black with scattering hazel hairs; tail pinkish cinnamon all around, the tip clove brown. *Variation*: Young specimen from type locality: Darker below than adult, and feet more varied with hazel. Immature specimen from Pike River, British Columbia: Upperparts cinnamon (without plumbeous bases to the hairs), tipped with pinkish buff; underparts cinnamon-rufous.*Skull*.¹—Longer and relatively narrower than that of *canadensis*, with narrower rostrum and interorbital region; bullae broader.*Measurements*.²—*Skull*: Subadult (male?) from Babine Mountains, British Columbia: Condyllo-basal length, 81.2; palatal length, 48; postpalatal length, 30; length of nasals, 33.4; zygomatic breadth, 52.7; breadth across mastoids, 39.8; least interorbital breadth, 19.8; breadth of rostrum, 17.2; maxillary tooth row, 20.*Remarks*.—This subspecies is the most northerly ranging member of the group. It occurs west of the continental divide in Yukon and northern British Columbia, but the limits of its range are not known. Only six skins have been seen. A specimen from near Teslin Lake, southern Yukon, is slightly darker below than the type (being uniform kaiser brown); the fore back is darker ochraceous, and the head blackish brown. Another specimen from Pike River, British Columbia, is dark blackish brown all over. A series of skulls without skins from Stuart Lake, British Columbia, is provisionally referred to this race.¹ No skulls from the type region available; description based on subadult specimen from Babine Mountains, British Columbia.² No external measurements available.

Specimens examined.—Total number, 15, as follows:

Alaska: Fortymile Creek (at head), 2.¹

British Columbia: Babine Mountains, 1 (skull); Pike River, Atlin, 2;² Stuart Lake, 8 (skulls); Tacla Lake, 1.

Yukon: Thirty Mile Mountains, near Teslin Lake, 1.³

Cranial Measurements of the *Marmota monax* Group.

No.	Species and locality.	Sex.	Condyllo-basal length.	Palatal length.	Postpalatal length.	Length of nasals.	Zygomatic breadth.	Breadth across maxilloids.	Least interorbital breadth.	Breadth of rostrum.	Maxillary tooth row.	Remarks.
<i>Marmota monax monax.</i>												
114009	Montgomery Co., Md.	♂	102.5	59.5	37.7	41.5	69.2	50.2	27.3	23.7	21.9	Old.
175010	Plummers Island, Md.	♂	97.5	56.7	37	41.8	66	46.5	25.9	21.2	21.2	Adult.
143962	Peaks of Otter, Va.	♂	98.1	58.1	36	40.5	65.7	47.2	27.2	20.7	21.2	Do.
58695	Roan Mountain, N. C.	♂	94	57.3	32.6	38.7	...	42.9	24.4	19.5	21.6	Do.
⁴ 447	Douglas County, Kans.	♂	98.7	58.8	36.5	43	...	45.7	27.2	19.7	20.6	Subadult.
125331	Bluemont, Va.	♂	93.7	56	35.3	40.6	61.9	45.8	26.5	19.9	21.2	Adult.
77926	Washington, D. C.	♂	90.4	53.4	33.7	38	59.5	44.3	23.5	21.3	20.5	Do.
⁴ 441	Douglas County, Kans.	♂	100.6	58.7	37.8	43	66.7	49.2	28.4	21.8	21.8	Do.
⁴ 448	do.	♂	95.8	56.3	35.4	43	67.3	48.5	29	23.2	21.9	Do.
⁶ 16029	Lake Forest, Ill.	♂	92	54	34.2	38.6	62.7	46.4	26	22.5	21.6	Do.
<i>Marmota monax rufescens.</i>												
186521	Elk River, Minn.	♂	87.2	50.9	32	35.5	64.7	45.1	24.2	18.7	20.4	Adult; type.
191338	do.	♂	89.8	52.2	34	37	59.8	43.4	23.5	20.5	20.9	Adult.
⁶ 3508	Fort Snelling, Minn.	♂	90.7	53.6	34.4	39.8	63.2	42.8	25.3	18.6	21.8	Do.
⁶ 1780	do.	♂	94.4	54.5	36.4	36	61.7	44	25.4	21.1	19	Do.
191244	Locust Grove, N. Y.	♂	90	53.2	32.6	35.5	64.5	44	25.5	21	20.6	Do.
(7)	Adirondack Mountains, N. Y.	♂	91.6	54.2	33.7	38.4	61.4	44.1	24.4	19.8	20.8	Do.
191339	Elk River, Minn.	♂	84.2	49.1	31.5	34.5	57.5	40.6	22.5	18.3	20	Do.
35361	Fort Snelling, Minn.	♂	87.8	52.4	31.8	39.1	62	43.8	23.7	20.4	21	Do.
122207	do.	♂	84	50.3	31.5	33.4	59.2	42	26.3	20	17.5	Do.
191250	Locust Grove, N. Y.	♂	86.3	51	32.5	37.8	60	42	21.8	17.5	20.2	Do.
(8)	Adirondack Mountains, N. Y.	♂	86.8	51.4	31.2	37.1	59.8	41.9	23.5	19.2	20.2	Do.
111091	Peterboro, N. Y.	♂	85	50.3	31.2	35.7	59.4	42	22.8	19.5	20.3	Do.
<i>Marmota monax preblorum.</i>												
78360	Wilmington, Mass.	♂	85.3	50.5	32	34.8	57.4	43.7	22.8	18.5	18.2	Adult; type.
78354	do.	♂	86.1	51.5	31.2	36.3	58.2	42.7	22.5	17.2	18.3	Adult.
78355	do.	♂	84	49.9	31.2	36.2	57.3	41.3	20.7	18.2	19.5	Do.
77111	Ossipee, N. H.	♂	85.4	49.7	31.6	36	60.4	43.6	23	19.5	18.9	Do.
⁶ 8235	Rutland, Vt.	♂	85	50.5	31	37.5	58	42.2	23.5	18.5	20.5	Do.
78356	Wilmington, Mass.	♂	79.1	47.7	28	33.7	54	37.7	19.8	16	18	Do.
78359	do.	♂	84.8	49.9	31.8	36.8	57.8	40	22.6	18.1	19	Do.
96083	Lunenburg, Mass.	♂	86.6	51.6	30.7	36.5	56.7	42	21.4	19.5	20.4	Do.
96142	do.	♂	81.6	48.7	30	35.3	58	41.5	22.6	18.3	19.6	Do.
<i>Marmota monax ignava.</i>												
⁹ 8871	L'Anse au Loup, Labrador	♂	87.4	51.2	32.5	35.5	63.4	41.7	26.8	19.7	20.8	Adult.
⁹ 8872	do.	♂	82.7	48.7	31	33.2	59	41.2	24.3	18.5	20	Do.
⁹ 8873	do.	♂	86.5	51	32	35.4	60.5	42	24	20.5	20.7	Do.
⁹ 8876	do.	♂	84.4	49.1	31.7	33.6	58.7	41.3	25	19.7	19	Do.
⁹ 8875	do.	♂	84	49.4	30.6	34.2	58.6	41.5	24.3	18.8	19.6	Do.
⁹ 7988	Black Bay, Labrador	♂	80.6	47.7	29.7	31.5	55.8	40	23	17.6	19.5	Do.
<i>Marmota monax canadensis.</i>												
⁵ 7607	Murray Bay, Quebec	♂	77.3	44	29.6	30.5	56.6	39.4	22.7	17.4	19.1	Adult.
⁵ 7608	do.	♂	75	43.7	28.8	32	53.2	36.4	21.7	16	18.7	Do.
⁶ 16209	Newport, Nova Scotia	♂	76.4	44.5	28.7	32	53	38.2	20.5	15.8	18.6	Subadult.
191344	Carberry, Manitoba	♂	79.2	46.3	27.5	31.7	...	36.5	20.5	15.1	19	Adult.
177740	Smith Portage, Mackenzie	♂	78.3	45.8	28.6	31	53.3	38	20.5	17.2	18.3	Do.
⁵ 7602	Murray Bay, Quebec	♂	77.6	45.6	28.8	33.5	56.6	38	22	17.8	19	Do.
⁵ 7608	do.	♂	78.7	46	29.6	32	53.2	39	20.4	17.1	18.4	Subadult.
110192	Oxford House, Manitoba	♂	79.7	47	28.4	33.3	54.7	37.2	21.1	15.9	18.7	Adult.
177378	Little Buffalo River, Mackenzie	♂	80	47.2	30.5	31.3	52.8	37.3	19.8	16.6	18.1	Do.
⁶ 16208	Newport, Nova Scotia	♂	79.6	46	30.3	33.3	58.2	39.8	22	17.2	19.2	Do.

¹ Collection Mus. Vert. Zool., Univ. of California.

² Collection Provincial Mus., Victoria, B. C.

³ Collection Victoria Mem. Mus.

⁴ Collection Kansas Univ. Mus.

⁵ Collection Field Mus. Nat. Hist.

⁶ Collection Amer. Mus. Nat. Hist.

⁷ Average of 10 adults, Merriam collection.

⁸ Average of 7 adults, Merriam collection.

⁹ Collection Mus. Comp. Zool.

Cranial measurements of the Marmota monax group—Continued.

No.	Species and locality.	Sex.	Condylö-basal length.	Palatal length.	Postpalatal length.	Length of nasals.	Zygomatic breadth.	Breadth across mastoids.	Least interorbital breadth.	Breadth of rostrum.	Maxillary tooth row.	Remarks.
<i>Marmota monax petrensis.</i>												
203532	Revelstoke, British Columbia....	♂	86	50.3	31.8	32.5	57.4	42	23	18.6	20	Adult; type.
101295	Barkerville, British Columbia..	♀	79	46.5	29.5	32.4	53.2	36	19.4	17.6	18.8	Adult.
<i>Marmota monax ochracea.</i>												
202785	Babine Mountains, British Columbia	[♂?]	81.2	48	30	33.4	52.7	39.8	19.8	17.2	20	Subadult.
77143	Stuart Lake, British Columbia..	[♂♂]	80.6	47.6	29.5	30.6	55.6	38.2	20.6	18.8	19	Adult.
77141	.....do.....	[♂?]	80.2	47.3	30.5	32.4	.....	38.1	19.8	17.2	17.6	Do.
77137	.....do.....	[♀?]	76.5	45	28.9	32.4	52	36.7	22	16.8	18.6	Do.
77140	.....do.....	[♀?]	77.1	45.4	29.3	31.4	51.3	36.2	19.6	17.4	.....	Do.

Marmota flaviventris Group.

[Characters under species.]

MARMOTA FLAVIVENTRIS (AUDUBON & BACHMAN).

[Synonymy under subspecies.]

External characters.—Size variable (small to medium);¹ tail relatively long (about 25 to 30 per cent of total length); ears small; sole pads as in the *monax* group (see Pl. III, fig. 2); mammae: P. $\frac{2}{2}$; A. $\frac{2}{2}$; I. $\frac{1}{1}$ = 10; head usually with white markings between eyes (absent or reduced in *obscura*); sides of neck with conspicuous buffy patches; feet varying from light buff to hazel or dark brown (never black); tail mixed hazel and dark brown (fading to clay color).

Cranial characters.—Skull similar in general outline to that of *monax*; interorbital region relatively narrower; postorbital processes longer and slenderer, projecting slightly back of a line drawn across their bases at right angles to axis of skull; nasals decidedly narrowed posteriorly, where their width is equal to or less than that of nasal branches of premaxillae; temporal ridges usually united in old age to form a well-defined but rather low sagittal crest; floor of basi-occipital with a median subcircular depression, bounded laterally by two low processes which converge and unite into a ridge near the inferior lip of the foramen magnum; posterior border of palate beveled at an obtuse angle; interpterygoid fossa relatively narrow; palatal foramina usually contracted posteriorly or of equal width throughout; molar teeth light; maxillary tooth rows slightly divergent anteriorly; anterior face of incisors yellowish white to zinc orange.

¹ Two adult male specimens of *M. flaviventris nosophora* weighed, respectively, 10 and 12 pounds; two adult males of *M. flaviventris dacota*, 8 and 17 pounds, the latter being very fat.

Color.—General tone of upperparts vinaceous- or orange-cinnamon, hazel, chestnut-brown, or vandyke brown; underfur of upperparts at base mouse gray, fuscous, bister, clove brown, or blackish brown, succeeded by pinkish-, ochraceous-, or cinnamon-buff, pinkish-, vinaceous-, or orange-cinnamon, cartridge- or tilleul-buff, buffy white, hazel, or pale russet; long hairs chestnut-brown, olive-brown, hazel, or black, tipped with light buff, ochraceous- or cinnamon-buff, or white; top of head and face cinnamon-drab, chestnut, bay, chestnut-, vandyke-, or clove-brown, or black; sides of face chestnut-brown or blackish brown, more or less mixed with white or buff; face usually more or less extensively marked with a band or patch of white or buff between the eyes (nearly obsolete in *obscura*); borders of nose, lips, and chin white or ochraceous-buff; sides of neck usually with conspicuous patches of ochraceous-buff or cinnamon-buff (nearly obsolete in *obscura*); underparts ochraceous-buff, ochraceous-tawny, hazel, chestnut-, kaiser-, or blackish-brown, often varied with russet, Sanford's brown, tawny, or pale buff; fore legs ochraceous-buff, tawny, hazel, russet, or kaiser brown, the feet chestnut-brown, russet, auburn, pinkish cinnamon, or cinnamon-buff; hind legs ochraceous-buff, tawny, or hazel (rarely brownish), the feet varying from light buff or pinkish cinnamon to russet, hazel, chestnut-brown, or blackish brown; tail above, hazel, tawny, chestnut-brown, blackish brown, or (in faded pelage) clay color; beneath, blackish brown or chestnut-brown; ears usually some shade of buff, bordered with dark brown.

Geographic distribution.—From the interior valleys of southern British Columbia south in the Great Basin to the Toyabe Mountains, Nev., and Parawan Mountains, Utah; in the Cascade-Sierra system, from Mount Hood, Oreg., to vicinity of Owens Lake, Cal.; and in the Rocky Mountain system, from Flathead Lake, Mont., to the Pecos River Mountains, N. Mex.;¹ east to the Black Hills, S. Dak.; confined to mountains, foothills, and rocky canyons, not occurring on the plains proper. (See fig. 2.)

Remarks.—*Marmota flaviventris* usually may be readily distinguished from *M. monax* by the more ochraceous coloration, by the buffy, hazel, or tawny legs and feet (the latter usually black or blackish brown in *monax*), and by the presence of white or buffy face markings; occasional specimens of *M. flaviventris obscura* and *M. flaviventris luteola* rather closely resemble certain specimens of the *monax* group, but always lack the deep reddish hairs on the fore legs.

¹ Formerly to the Manzano and Datil Mountains (vicinity of Old Fort Tularosa).

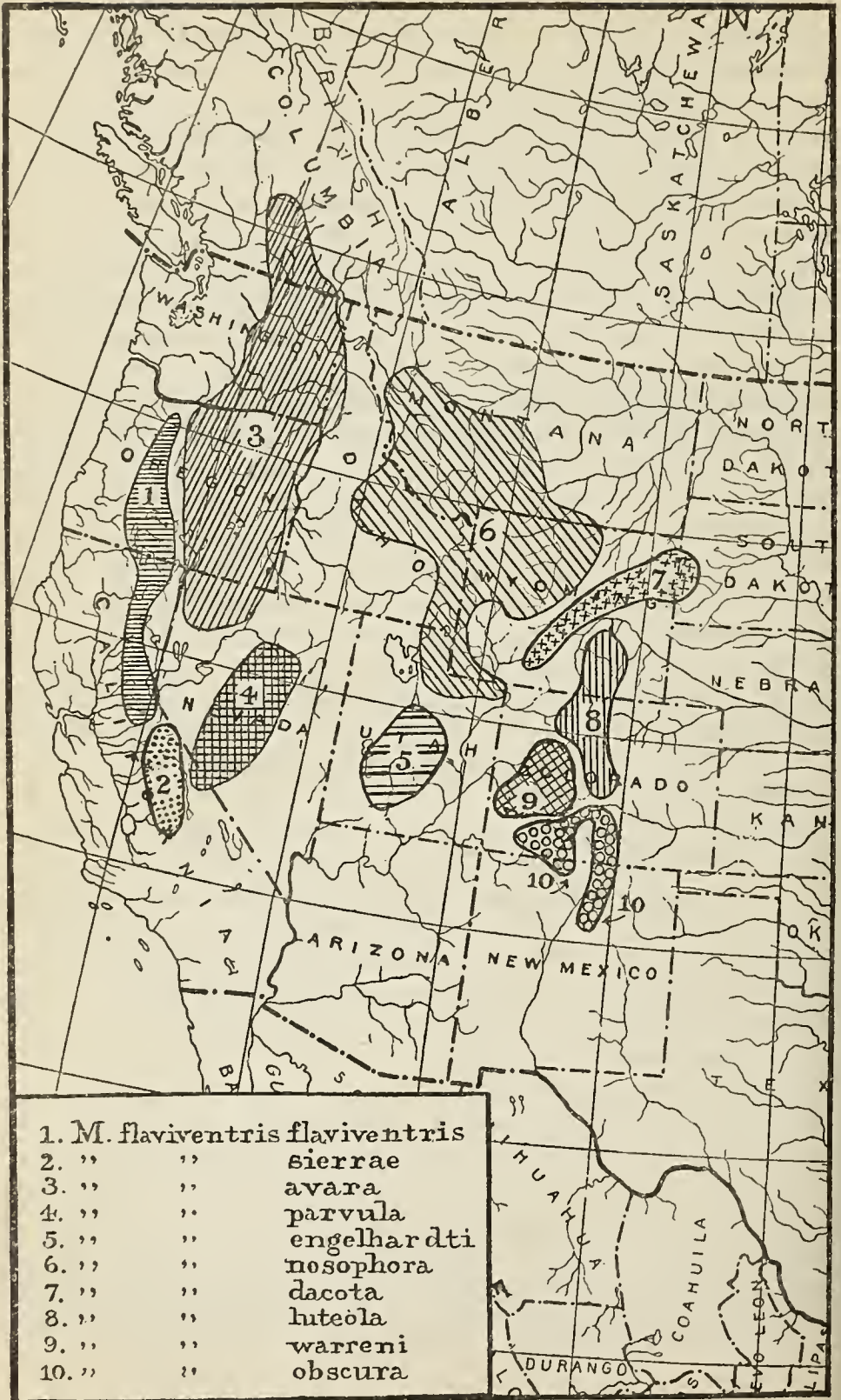


Fig. 2.—Distribution of the *Marmota flaviventris* group. Unshaded areas within the range of the group indicate a lack of definite knowledge as to the subspecies occurring there.

MARMOTA FLAVIVENTRIS FLAVIVENTRIS (AUDUBON & BACHMAN).

YELLOW-BELLIED MARMOT.

(Pl. III, fig. 2; Pl. VII, fig. 1; Pl. XIII, fig. 1.)

Arctomys flaviventer Audubon & Bachman, Proc. Acad. Nat. Sci. Philadelphia, 1841, p. 99; Quad. N. Am., III, 1853, p. 160, Pl. CXXXIV.

[*Marmota*] *flaviventer* Trouessart, Cat. Mamm. Suppl., 1904, p. 344.

Type locality.—"Mountains between Texas and California"—here fixed on Mount Hood, Oreg. (See remarks following, p. 40.)

Distribution.—The Cascade Range in Oregon and the northern Sierra in California, south to Lake Tahoe.

Characters.—Size large; general tone of upperparts russet, grizzled with white, the fore back sometimes overlaid with a rather indistinct buffy mantle; underparts ochraceous-buff to hazel; feet ochraceous or hazel; skull massive.

Color.—Underfur of upperparts deep mouse gray at base, succeeded by a broad area of buffy white, the latter shading on hinder back to pinkish cinnamon (sometimes to hazel); long hairs chestnut-brown or clove brown subterminally, tipped on fore back with light buff, on hinder back with white; top of head and face chestnut-brown to blackish brown, sometimes varied with cinnamon-drab, with an indistinct band of buffy white or ochraceous-buff across face in front of eyes; sides of face mixed chestnut-brown and cinnamon-buff; sides of neck with large patches of light ochraceous-buff; fore legs and feet tawny to hazel; hind feet light ochraceous-buff more or less varied with light hazel; tail hazel (fading to clay color), the bases of the hairs and under surface natal brown, varying to chestnut-brown or blackish brown; underparts ochraceous-buff, varying to hazel, becoming light ochraceous-buff around base of tail, the bases of some of the hairs indistinctly chestnut-brown; sides of nose, lips, and chin white, often varied with ochraceous-tawny around nose and edged with hazel or kaiser brown on throat.

Skull.—Largest of any member of the group; relatively long and narrow; nasals long, and narrow posteriorly; nasal branches of premaxillae broad; postorbital constriction broad; rostrum long and narrow; palatal foramina narrow.

Measurements.—Adult male from Donner, Cal.: Total length, 700; tail vertebrae, 180; hind foot, 90. Adult female from Crater Lake, Oreg.: 640; 170; 80. Adult female from Donner, Cal.: 600; 170; 85. *Skull*: Adult male:¹ Condyllo-basal length, 92.5–97.1 (average 94.5); palatal length, 52.3–55 (53.8); postpalatal length, 37.6–38.2 (37.9); length of nasals, 42.5–42.6; zygomatic breadth, 62.3; breadth across mastoids, 41.1–46.2 (43.9); least interorbital breadth, 21.2–23 (22.1); breadth of rostrum, 22.3–23 (22.8); maxillary tooth row, 19.5–

¹ Three specimens from Mount Hood, Oreg., and Fort Crook and Donner, Cal.

20.9 (20.1). Adult female:¹ Condyllo-basal length, 82–87 (84.2); palatal length, 45.8–48.7 (47.6); postpalatal length, 30.6–34.5 (34.1); length of nasals, 34.5–37.2 (35.9); zygomatic breadth, 54.4–58.4 (55.9); breadth across mastoids, 38.5–40.7 (39.8); least interorbital breadth, 17.3–19.3 (18.5); breadth of rostrum, 17.8–21.4 (19.8); maxillary tooth row, 19.5–22.1 (20.5).

Remarks.—This species was described in 1841 and the name has been in use ever since in a broad sense for the marmots of the Sierra-Cascade range and, by most authors, for the Rocky Mountain forms as well. The original describers' statement as to the source of the type specimen—"mountains between Texas and California"—is not only too indefinite to be of use, but the evidence points to its being incorrect. The type specimen, as stated by Audubon and Bachman, was obtained by David Douglass and (the skin only) is still in a fair state of preservation in the British Museum, but unfortunately is unaccompanied by data to show where it was collected. Douglass's journal has been published,² and from it we learn that he spent a considerable time at Fort Vancouver near the mouth of the Columbia River, whence he made journeys up the Columbia and Willamette Valleys and through eastern Washington and southern British Columbia. He spent some time, also, on the coast of California, below Monterey, but apparently never visited either the Sierra or the Cascades proper. His journal does not mention the capture of any marmots.³ He might easily have secured the type specimen on his journey through eastern Washington, in which case it would be the form now known as *avara*, or he might have obtained it from Indians or travelers who had visited Mount Hood—a comparatively short distance from his headquarters—in which case it would be referable to the form which now bears the name *flaviventris*. In order to settle the question a specimen from Mount Hood and one from Okanogan, British Columbia, were submitted to Oldfield Thomas, who compared them with the type in the British Museum. He states as follows:

The underside of forearms [in the type] are about as rufous and its rump as brown and finely speckled as the Oregon specimen, but it has got distinctly the broadly buffy mantle on the fore back so marked in the British Columbia specimen. The type is a good adult skin which has borne remaking very well. The skull, unfortunately, is not in existence.

The buffy mantle of which Mr. Thomas speaks is not a diagnostic character, since it appears in both the British Columbia and Cascade forms. The rufous color of the fore legs, however, is diagnostic,

¹ Seven specimens from Crater Lake, Oreg., and northern parts of Sierra Nevada, Cal.

² Hooker, W. J. Companion to Botanical Mag., II, 1836, pp. 79–182.

³ The statement [p. 92] that a curious species of *Arctomys* was secured and other references to "*Arctomys brachyurus*" [pp. 101–115] doubtless refer to species of either *Citellus* or *Aplodontia*.

and, except for size and cranial characters, is the only sure distinguishing characteristic of the two forms. It seems clear, therefore, that the name *flaviventris* must be applied to the darker of the two forms found in Oregon and Washington, and I have therefore selected Mount Hood, Oreg., as the type locality. The series available from the Cascades is small and contains only one adult male skull—an old weathered specimen picked up on Mount Hood. Several adult females in the collection from Crater Lake and the Klamath Lake region, however, agree essentially with specimens from Fort Crook and the northern Sierra of California. South of Lake Tahoe *flaviventris* grades imperceptibly into the subspecies *sierrae*, occupying the southern end of the Sierra Nevada, in the Mount Whitney region. Intergradation with *avara* occurs in the region east of Klamath Lake and probably all along the east base of the Cascades.

Specimens examined.—Total number, 48, as follows:

California: Donner, 17; Emerald Bay, 1; Fort Crook, 3; Glen Alpine Springs, El Dorado County, 2;¹ Hope Valley, Alpine County, 2; Lassen Creek, Warner Mountains, 1; Mount Lassen, 2; Pine Creek, Lassen County, 1.

Nevada: Mount Siegel, Douglas County, 1;² Winters Mine, Douglas County, 1.²

Oregon: Crater Lake, 2; Fort Klamath, 3; Klamath Lake, 6; Linkville, 2; Mount Hood, 3; Summer Lake, 1.

MARMOTA FLAVIVENTRIS AVARA (BANGS).

PALLID YELLOW-BELLIED MARMOT.

(Pl. VII, fig. 3; Pl. XIII, fig. 3.)

Arctomys flaviventer avarus Bangs, Proc. New England Zool. Club, I, 1899, p. 68.

[*Marmota flaviventer*] *avarus* Trouessart, Cat. Mamm., Suppl., 1904, p. 344.

Type locality.—Okanogan, British Columbia.

Distribution.—Interior valleys and foothills of southern British Columbia and eastern Washington and Oregon.

Characters.—Similar to *flaviventris*, but smaller and colors paler, especially the underfur and fore legs; upperparts more extensively overlaid with buff.

Color.—General tone of upperparts chestnut-brown, heavily grizzled with buff; underfur at base deep mouse gray (varying to pale fuscous) succeeded by buffy white, the latter shading to light pinkish cinnamon on hinder back; long hairs blackish brown or clove brown subterminally, extensively tipped on fore back with warm buff and on hinder back with light buff; head and face blackish brown or dark chestnut-brown, with an indistinct narrow band of white or buff across face in front of eyes; sides of neck warm buff; fore legs and feet ochraceous-buff; hind legs, hind feet, and buttocks light ochraceous-buff, the feet varying to hazel; tail hazel, the hairs tipped

¹ Collection Mus. Vert. Zool., Univ. of California.

² Collection Field Mus. Nat. Hist.

with warm buff, their bases chestnut-brown; underparts ochraceous-buff or light ochraceous-buff, the bases of the hairs on belly chestnut-brown; sides of nose, lips, and chin white, bordered on throat with hazel.

Skull.—Similar to that of *flaviventris*, but decidedly smaller; nasals shorter, ending but little back of posterior border of premaxillae.

Measurements.—Adult male: ¹ Total length, 495–660 (average 554); tail vertebrae, 149–178 (165); hind foot, 76–80 (78). *Skull*: Adult male: ² Condyllo-basal length, 85.7–86.5 (86.1); palatal length, 47.9–48.8 (48.3); postpalatal length, 34–34.8 (34.4); length of nasals, 36.6–37.6 (37.1); zygomatic breadth, 55.6–56.7 (56.1); breadth across mastoids, 39.1–42.2 (40.6); least interorbital breadth, 17.8–19.5 (18.6); breadth of rostrum, 19.4–20 (19.7); maxillary tooth row, 19–19.3. Adult female: ³ Condyllo-basal length, 76.4–79.4 (77.9); palatal length, 42.6–44.6 (43.6); postpalatal length, 30.3–31 (30.7); length of nasals, 31.5–33.5 (32.8); zygomatic breadth, 52.4–52.7 (52.5); breadth across mastoids, 37.6–38.6 (38); least interorbital breadth, 17.1–18 (17.6); breadth of rostrum, 16.8–18.3 (17.3); maxillary tooth row, 17.8–19.1 (18.5).

Remarks.—This is a small, pale race of *flaviventris* living in the low foothills of eastern Oregon and Washington and southern British Columbia. It intergrades with *flaviventris* along the eastern base of the Cascades, in Oregon; with *nosophora* in northwestern Montana; and probably with *parvula* in northern Nevada. Specimens from Spokane Bridge, Wash., are a little darker than the typical form, and one from Elgin, Oreg., has a slightly larger skull. Specimens from Rockland, Wash., are intermediate between *avara* and *flaviventris*. Melanistic individuals are rare in this race; one from Pullman, Wash., has the fore back solid black, faintly grizzled with white, and the underfur pale gray; the hinder back is gray, the hairs being black subterminally and tipped with white; the belly and feet are black varied with buff; and the tail is black varied with tawny and white.

Specimens examined.—Total number, 53, as follows:

British Columbia: Ashcroft, 8; Cascade, 6;⁴ Midway, 9;^{4,5,6} Nicola Valley, 1;⁶ Okanogan, 9; Penticton, 1;⁴ Vernon, 1.

Oregon: Elgin, 2; Harney, 2; Guano Creek, Lake County, 1.

Washington: Cheney, 1; Diamond, 1; Douglas, 1; Pullman (14 miles southwest), 1; Rockland, 4; Spokane Bridge, 5.

¹ Four specimens from Okanogan, British Columbia; and Douglas, Wash.

² Two specimens from Okanogan and Cascade, British Columbia.

³ Four specimens from southern British Columbia.

⁴ Collection Victoria Mem. Mus.

⁵ Collection Field Mus. Nat. Hist.

⁶ Collection Amer. Mus. Nat. Hist.

MARMOTA FLAVIVENTRIS SIERRAE SUBSP. NOV.

SOUTHERN SIERRA MARMOT.

(Pl. IV, fig. 4.)

Type from head of Kern River, Mount Whitney, Cal. (altitude, 9,300 feet). Adult ♀, No. $\frac{3}{4}\frac{99}{83}\frac{4}{5}$, U. S. Nat. Mus., Biological Survey collection. Collected Sept. 3, 1891, by Vernon Bailey; original number, 3242.

Distribution.—Higher parts of the southern Sierra Nevada from upper Kern River north to vicinity of Mono Lake.

Characters.—Similar to *flaviventris*, but colors redder and buffy mantle reduced or obsolete; skull smaller.

Color.—General tone of upperparts vinaceous-cinnamon to mikado brown, narrowly grizzled with white; underfur at base pale bister succeeded by pale pinkish buff, shading at tips into vinaceous-cinnamon and on hinder back to orange-cinnamon or mikado brown; long hairs chestnut-brown or blackish brown subterminally, tipped with white or buffy white; top of head and face dark cinnamon-drab to clove brown, with a rather large patch of white in front of eyes; sides of neck warm buff; fore legs and feet hazel varied with light ochraceous-buff; hind feet similar, or sometimes light buff, varied with brown; tail hazel, the bases of hairs light bister; underparts light ochraceous-buff, much mixed on sides and belly and bordered on throat with mikado brown.

Skull.—Similar to that of *flaviventris*, but decidedly smaller; very similar to that of *avara* but averaging slightly larger, and nasals longer.

Measurements.—Adult male topotype: Total length, 600; tail vertebrae, 200; hind foot, 83. Adult male:¹ 600; 165; 80. Adult female:² 555–645 (average 593); 167–186 (176); 75–80 (77). *Skull*: Adult male:³ Condyllo-basal length, 79.1–85.5 (average 84.7); palatal length, 44–50.5 (47.7); postpalatal length, 30.8–35 (33); length of nasals, 32.6–39 (36.3); zygomatic breadth, 52–58.3 (55.8); breadth across mastoids, 37.5–43.6 (40.8); least interorbital breadth, 17–20.3 (18.1); breadth of rostrum, 17–20 (18.6); maxillary tooth row, 20.2–20.7 (20.4). Adult female:² Condyllo-basal length, 77.1–83.2 (80.1); palatal length, 43.2–47.2 (45.5); postpalatal length, 28.7–32.2 (30.5); length of nasals, 30.7–36.5 (34.2); zygomatic breadth, 51.4–55.4 (53.6); breadth across mastoids, 37–40 (38.4); least interorbital breadth, 15–18.7 (17.2); breadth of rostrum, 17.4–20.2 (18.4); maxillary tooth row, 19–20.2 (19.7).

Remarks.—By reason of the scarcity of specimens from the Cascades (the type region of *flaviventris*) it is impossible satisfactorily to

¹ One specimen from East Fork Kaweah River, Cal.

² Five specimens from southern Sierra Nevada, Cal.

³ Six specimens from southern Sierra Nevada, Cal.

characterize this southern race. The available specimens, however, show a decided reduction in size of skull southward, the small form apparently being confined to the high Sierra south of Mono Lake. Intergradation with *flaviventris* occurs in the region between Mono Lake and Lake Tahoe, and with *parvula* in the White Mountains, on the boundary between California and Nevada.

Specimens examined.—Total number, 47, as follows:

California: Big Meadows, Tulare County, 3; Bishop Creek (altitude, 8,000 feet), 2; Cannell Meadows, Tulare County, 2;¹ Cottonwood Lakes, Inyo County, 3;¹ Independence Lake, 1;¹ Kaweah River (East Fork), 3; Lake Tenaya, 1; Menache Meadows (near Olancha Peak), 1; Mount Lyell, 1; Mount Whitney, 9; Mulkey Meadows (15 miles south of Mount Whitney), 1; Owens River (near Mammoth Pass), 1; Round Valley (12 miles south of Mount Whitney), 2; San Joaquin River (near head), 4; Siberian Outpost, Tulare County, 1;¹ Tuolumne Meadows, 10; Whitney Creek, Tulare County, 1;¹ Whitney Meadow, Tulare County, 1.¹

MARMOTA FLAVIVENTRIS PARVULA HOWELL.

NEVADA MARMOT.

(Pl. VII, fig. 2; Pl. XIII, fig. 2.)

Marmota flaviventer parvula Howell, Proc. Biol. Soc. Washington, XXVII, 1914, p. 14.

Type locality.—Jefferson, Toquima Range, Nye County, Nev. (about 10 miles north of Belmont).

Distribution.—Toyabe and Toquima Ranges, Nev.; and White Mountains, Cal. (occurring from about 7,800 to 10,000 feet altitude); probably occupies also other desert ranges in central Nevada.

Characters.—Similar to *avara*, but smaller and colors darker; in color resembling *sierrae*, but upperparts less reddish and overlaid with a buffy mantle; skull smaller than that of *avara*, with narrower rostrum.

Color.—Underfur of upperparts slaty fuscous at base, succeeded by a broad area of cartridge buff on fore back and by light vinaceous-cinnamon on hinder back; long hairs dark brown subterminally, tipped on fore back with warm buff and on hinder back with white; top of head and face dark vandyke brown; a band of buff or buffy white across face in front of eyes; sides of nose and lips and a large patch on chin white varied with buff; sides of neck with a conspicuous patch of warm buff or cinnamon-buff; underparts ochraceous-tawny, shading to russet on abdomen and throat; fore legs tawny or russet, tipped with ochraceous-buff; fore and hind feet varying from light pinkish cinnamon to russet; tail above, dark chestnut-brown varied with tawny and grizzled with buff; beneath, blackish brown.

Skull.—Similar to that of *avara*, but decidedly smaller, with rostrum narrowed anteriorly.

Measurements.—Adult female:¹ Total length, 470–500 (average, 480); tail vertebrae, 130–150 (141); hind foot, 70. *Skull:* Adult female:² Condyllo-basal length, 71.3–73 (72.2); palatal length, 39.4–41 (40.2); postpalatal length, 27–28.6 (27.8); length of nasals, 29.4–30.5 (30); zygomatic breadth, 48.6–49 (48.8); breadth across mastoids, 34.2–34.3; least interorbital breadth, 15.5–15.6; breadth of rostrum, 17.2–17.4 (17.3); maxillary tooth row, 17.7–18.6 (18.2).

Remarks.—This is the smallest of the races of *flaviventris*. It most resembles typical *flaviventris* in color, but is even smaller than *avara*. Its small size was noted in the field by Vernon Bailey, who collected the type series. The range of the subspecies is not definitely known but probably extends at least to the Ruby Mountains where, on top of one of the peaks, Mr. Bailey found evidences of the presence of marmots.

A small series in badly worn pelage from White Mountains, Cal., is provisionally referred to this race, the specimens being intermediate in size between *parvula* and *sierrae*, and agreeing fairly well in color with the former, except for a stronger suffusion of red. One adult female skull agrees with skulls of *parvula* while a subadult male agrees equally well with comparable specimens of *sierrae*.

Two very young specimens from Mountain City, northeastern Nevada, are also provisionally referred to this race.

Specimens examined.—Total number, 16, as follows:

Nevada: Arc Dome, Toyabe Range, 6; Jefferson, Toquima Range, 1; Mountain City, 2.

California: White Mountains (altitude 9,300–10,000 feet), 7.

MARMOTA FLAVIVENTRIS ENGELHARDTI ALLEN.

ENGELHARDT MARMOT.

(Pl. VII, fig. 4; Pl. XIII, fig. 4.)

Marmota engelhardti Allen, Mus. Brooklyn Inst. Arts & Sci., Sci. Bul., I, 1905, p. 120.

Type locality.—Briggs [=Britt's] Meadow, Beaver Range, Utah (altitude 10,000 feet).

Distribution.—Beaver and Parawan Mountains, southern Utah; also Midvale, Idaho; exact limits of range unknown.

Characters.—Similar to *flaviventris* but smaller; underparts and hind feet darker (redder); buffy patches on sides of neck less extensive; larger than *parvula*, with darker feet and underfur; skull similar to that of *avara* but bullae larger.

Color.—General tone of upperparts vandyke brown, grizzled with buffy white; underfur fuscous at base succeeded by pinkish buff or pinkish cinnamon, the latter shading on sides to Rood's brown; long hairs blackish brown, tipped with light buff or buffy white; top of

¹ Three specimens from Toyabe and Toquima Ranges, Nev. ² Two specimens from same localities.

head and face blackish brown, with an irregular white patch in front of eyes; sides of head mixed brown and buffy white; sides of neck with a small area of ochraceous-buff; legs and feet hazel; tail above, dark clove brown, tipped with hazel; beneath, blackish brown; underparts hazel or ochraceous-tawny, the bases of hairs blackish brown; sides of nose, lips, and chin, white.

Skull.¹—Similar to that of *avara* but audital bullae averaging larger and more inflated.

Measurements.—Adult female topotype: Total length, 525; tail vertebrae, 110;² hind foot, 75. Adult female from Parawan Mountains, Utah: 554; 154; 68. Immature female topotypes:³ 485–535 (average 507); 139–163 (151); 71–77 (73). *Skull*: Adult female:⁴ Condylobasal length, 76.8–80 (78.4); palatal length, 43.5–46.1 (44.8); postpalatal length, 29.5–30.7 (30.1); length of nasals, 31–34.6 (32.8); zygomatic breadth, 52.3–54 (53); breadth across mastoids, 36.5–37.7 (37.2); least interorbital breadth, 16.3–18 (17.1); breadth of rostrum, 17.8–18 (17.9); maxillary tooth row, 18.8–19 (18.9).

Remarks.—This race is an intermediate form connecting *flaviventris* and *nosophora*, darker beneath than the former but not so reddish as the latter and lacking also its buffy mantle. It is about the size of *avara* with a somewhat shorter tail, but much darker in color. A specimen from Parawan Mountains, Utah, is paler beneath than the type and topotypes, the underparts (except throat) and hind feet being ochraceous-buff varied with brownish. An immature specimen from Midvale, Idaho, provisionally referred to this form, agrees with it in color, except that the underfur on the shoulders is paler (light buff), and in skull characters so far as they can be determined.

Specimens examined.—Total number, 12, as follows:

Idaho: Midvale, 1.

Utah: Beaver Mountains, 6;⁵ Parawan Mountains, 5.

MARMOTA FLAVIVENTRIS NOSOPHORA HOWELL.

GOLDEN-MANTLED MARMOT.

(Pl. I; Pl. VIII, fig. 1; Pl. XIV, fig. 1.)

Marmota flaviventer nosophora Howell, Proc. Biol. Soc. Washington, XXVII, 1914, p. 15.

Type locality.—Willow Creek, 7 miles east of Corvallis, Mont. (altitude 4,000 feet).

Distribution.—Rocky Mountain region of Montana, Idaho, and Wyoming, from Flathead Lake, Mont., south to the Wasatch Mountains, Utah, and east to the Bighorn Mountains, Wyo.; altitudinal range from about 3,000 to 11,800 feet.

¹ No adult males examined.

² Apparently abnormally short.

³ Three specimens.

⁴ Three specimens from Beaver and Parawan Ranges, Utah.

⁵ Including type in collection Amer. Mus. Nat. Hist.

Characters.—About the size of *engelhardti*, but with longer tail; colors much more ochraceous above and redder below, the fore part of back overlaid with a mantle of golden buff. Compared with *dacota*: Slightly smaller, with upperparts less extensively reddish and more mixed with black, and underfur decidedly paler; skull averaging smaller, with relatively slenderer rostrum and much smaller palatal foramina.

Color.—Underfur of upperparts at base blackish brown on fore part of body, becoming fuscous on hinder parts, succeeded by a broad area of whitish buff (tulleul buff of Ridgway) shading (on hinder back) to pinkish cinnamon or pale russet; long hairs black subterminally, broadly tipped on fore part of back with warm- or ochraceous-buff and on hinder part with white or buffy white; top and sides of head blackish brown, with a conspicuous band of white or buffy white across face in front of eyes; sides of face mixed with cinnamon or white; sides of nose, lips, and chin white or buffy white; sides of neck with ochraceous-buff patches behind ears; fore legs kaiser brown; hind legs and rump warm buff; hind feet hazel to russet; tail chestnut-brown or blackish brown, varied with hazel or cinnamon-buff (fading to dull cinnamon or clay color); underparts hazel shaded with kaiser brown, becoming bright chestnut on throat and sometimes on belly. *Variation:* A dark, brownish color-phase occurring rarely, and seemingly most frequent at high altitudes, may be described as follows: General tone of upperparts dark brown grizzled with white; underfur at base mouse gray (shading on hinder back to fuscous) succeeded by buffy white (shading on hinder back to light pinkish cinnamon); long hairs blackish brown, tipped with white; top and sides of head blackish brown; underparts mixed blackish brown and pinkish buff in about equal proportions; throat shaded with russet; feet and tail blackish brown; legs brownish mixed with ochraceous-tawny. (Specimen from Lake Fork, Wind River Mountains, Wyo.; altitude 10,600 feet.)

Skull.—Females averaging larger than those of *engelhardti*, with broader rostrum and interorbital region and smaller bullae. Compared with *dacota*: Smaller, with narrower rostrum and interorbital region, and much smaller palatal foramina.

Measurements.—Adult male:¹ Total length, 590–600 (average 595); tail vertebrae 159–170 (165); hind foot, 78–79 (78.5). Old male from Pryor Mountains, Mont.: 670; 165; 96. Adult female:² 534–591 (565); 145–175 (165); 75–85 (78). *Skull:* Adult male:³ Condylobasal length, 86.7–94.2 (90.6); palatal length, 47.7–53 (50.7); post-palatal length, 34.2–37.2 (36.2); length of nasals, 35.1–40.4 (37.8); zygomatic breadth, 55.7–63.7 (59); breadth across mastoids, 41.3–45

¹ Two specimens from Bitterroot Valley, Mont.

² Seven specimens from Bitterroot Valley, Mont.

³ Six specimens from Montana, Idaho, and Wyoming.

(43); least interorbital breadth, 17.8–22.2 (20.1); breadth of rostrum, 19–20.5 (19.8); maxillary tooth row, 19.3–20.8 (20). Adult female:¹ Condyllo-basal length, 78.2–83.8 (80.4); palatal length, 44.1–47 (45.1); postpalatal length, 29.4–33.5 (31.2); length of nasals, 30.8–34.8 (32.4); zygomatic breadth, 53.2–54.5 (53.9); breadth across mastoids, 37.4–41.6 (39); least interorbital breadth, 18.5–19.7 (19.1); breadth of rostrum, 17–19.3 (18.3); maxillary tooth row, 19.7–20.5 (20.1).

Remarks.—This subspecies, one of the handsomest members of the *flaviventris* group, is abundant and generally distributed in the northern Rocky Mountain region of Montana, Idaho, and Wyoming. Closely related to *dacota* of the Black Hills, it probably intergrades with that race in central Wyoming. Specimens from the northern limit of its range (Horse Plains and Weeksville, Mont.) are considerably paler than the typical form, showing approach to *avara*. The southern limits of the range of *nosophora* are not known, only a few specimens having been seen from the Wasatch Mountains, and none from the Uinta Mountains, Utah. Intergradation with *engelhardti* probably occurs where their ranges meet.

A brown phase of this subspecies, having the tips of the hairs white instead of cinnamon-buff and the underparts mixed brown and buff instead of red, occurs in some localities with the normal phase. Several immature specimens, varying somewhat in color, have been examined from near timberline in the Wind River Mountains, Wyo. An adult female in very worn pelage from timberline in the Beartooth Mountains, Mont., is similar to those from the Wind River Mountains, but the brown of the upperparts is paler, evidently faded, and the underparts are mixed chestnut and black, shaded with tawny. Some specimens in this phase somewhat resemble externally the members of the *monax* group but the skulls are typical of *nosophora*.

This marmot serves as a host for the Rocky Mountain fever tick (*Dermacentor venustus*) and thus aids in the dissemination of the deadly spotted fever, particularly along the western side of the Bitterroot Valley, Mont., where the disease occurs in its most virulent form.

Specimens examined.—Total number, 62, as follows:

Idaho: Bear Lake (east side), 1; Bridge, 1; Conant Creek (upper Snake River), 1; Grace, 2; Henry Fork of Snake River, 1; Irwin (20 miles northwest), 1; Island Park, Snake River, 1; Moody Creek (upper Snake River), 1; Preuss Mountains, 1; Sawtooth National Forest, 2; Teton Basin, 1.

Montana: Bass Creek (in mountains northwest of Stevensville), 3; Beartooth Mountains, 3; Bozeman, 1; Como Lake, 1; Florence, 2; Horse Plains, 4; Jardine, 1; Pryor Mountains, 2; Ross Fork (15 miles above Darby), 2; Weeksville, 1; Willow Creek (in mountains east of Corvallis), 3.

¹ Five specimens from Bitterroot Valley, Montana.

Utah: Blacksmith's Fork (near head), 1; Laketown, 1; Park City, Wasatch Mountains, 3.

Wyoming: Bighorn Mountains (Trapper's Creek), 6; Fremont Peak, 2; Jackson, 2; Kendall (12 miles north), 1; Lake Fork, Wind River Mountains, 3; Little Sandy Creek, 3; Lost Cabin (15 miles northwest), 1; Pahaska, 1; Salt River Mountains (10 miles southeast of Afton), 1; Sheridan, 1.

MARMOTA FLAVIVENTRIS DACOTA (MERRIAM).

BLACK HILLS MARMOT.

(Pl. IV, fig. 1; Pl. VIII, fig. 3; Pl. XIV, fig. 2.)

Arctomys flaviventer Grinnell, Ludlow's Black Hills of Dakota, 1875, p. 82. (Not of Audubon & Bachman).

Arctomys dacota Merriam, N. Am. Fauna No. 2, 1889, p. 8.

[*Marmota*] *dacota* Trouessart, Cat. Mamm., Suppl., 1904, p. 344.

Type locality.—Custer, S. Dak.

Distribution.—Black Hills, S. Dak., and Bear Lodge Mountains, Wyo., southwest to Bridger Pass, Wyo.

Characters.—Size large (equaling *flaviventris*); color similar to that of *nosophora* but underfur redder and less mixed with black; skull large, with broad rostrum and very large palatal foramina.

Color.—General tone of upperparts orange-cinnamon overlaid with warm buff; underfur at base fuscous or dark mouse gray, succeeded by pinkish cinnamon or vinaceous-cinnamon on fore back and by orange-cinnamon on hinder back, darkening to kaiser brown on sides (sometimes vinaceous-cinnamon to roots on fore back); long hairs on fore back bright cinnamon-buff at tips with an indistinct subterminal band of hazel or chestnut-brown; on hinder back chestnut-brown or blackish brown, tipped with white; buttocks warm buff; top of head and nose blackish brown with a band of yellowish white across face in front of eyes; sides of nose, lips, and chin, white or yellowish white; fore legs kaiser brown, feet russet; hind feet hazel; tail above, hazel mixed with chestnut-brown; beneath, blackish brown; underparts kaiser brown shaded with ochraceous-buff.

Skull.—Similar to that of *nosophora* but larger, with broad rostrum and broad palatal foramina.

Measurements.—Adult male:¹ Total length, 610–680 (average 643); tail vertebrae, 178–200 (185); hind foot, 81–92 (85). Adult female:² 525–627 (602); 130–188 (168); 79–84 (81). *Skull:* Adult male:³ Condyllo-basal length, 89.4–95.7 (92.5); palatal length, 50.8–52.2 (51.6); postpalatal length, 35–38.2 (36.6); length of nasals, 37.8–41.1 (39); zygomatic breadth, 59.5–61.4 (60.7); breadth across

¹ Five specimens from Black Hills, S. Dak., and Bear Lodge Mountains, Wyo.

² Five specimens from Black Hills, S. Dak.

³ Three specimens from Black Hills, S. Dak., and Bear Lodge Mountains, Wyo.

mastoids, 42.3–44.7 (43.3); least interorbital breadth, 21.8–23.2 (22.6); breadth of rostrum, 22–23.6 (23); maxillary tooth row, 21–21.7 (21.4). Adult female:¹ Condylar-basal length, 81.4–84.5 (83.1); palatal length, 45.4–47.7 (46.8); postpalatal length, 31.6–33 (32.4); length of nasals, 31.5–35.5 (33.9); zygomatic breadth, 54.2–56.7 (55.5); breadth across mastoids, 39.4–42.3 (40.5); least interorbital breadth, 19.6–22.5 (20.6); breadth of rostrum, 20–22.3 (20.9); maxillary tooth row, 20.1–20.5 (20.4).

Remarks.—This form is the brightest of all the races of the species, the red and yellow shades being most pronounced and the blacks and browns reduced to a minimum. It is abundant in the Black Hills and apparently ranges through eastern Wyoming to Bridger Pass, intergrading with *luteola* in the Laramie Mountains.

Specimens examined.—Total number, 19, as follows:

South Dakota: "Black Hills," 1; Custer, 8; Savoy, 5; Tigerville (near Hill City), 1.

Wyoming: Bear Lodge Mountains, 1; Bridger Pass, 3.

MARMOTA FLAVIVENTRIS LUTEOLA HOWELL.

PARK MARMOT.

(Pl. VIII, fig. 2; Pl. XIV, fig. 3.)

Arctomys flaviventer Allen, Bul. Essex Inst., VI, 1874, p. 57. (Not of Audubon & Bachman.)

Marmota flaviventer Warren, Colorado Coll. Pub., Sci. Ser., XI, No. 46, 1906, p. 243. (Not of Audubon & Bachman.)

Marmota engelhardti Cary, N. Am. Fauna No. 33, 1911, p. 98. (Not of Allen.)

Marmota flaviventer luteola Howell, Proc. Biol. Soc. Washington, XXVII, 1914, p. 15.

Type locality.—Woods P. O., in Medicine Bow Mountains, Wyo. (altitude about 7,500 feet).

Distribution.—Mountains of northern Colorado and southeastern Wyoming, from Park County, Colo., (and probably Fremont County) north to the Laramie Mountains, Wyo.

Characters.—About the size of *dacota* and similar in color to it and *nosophora*, but underparts yellowish instead of deep red, and fore back overlaid with white instead of warm buff; skull similar to that of *nosophora*, but averaging narrower.

Color.—*Normal phase:* Underfur of upperparts dark mouse gray at base (shading on hinder back to deep dusky drab), succeeded on fore back by a broad area of warm buff and on hinder back by ochraceous-buff; long hairs blackish brown or dark chestnut-brown, tipped with light buff or buffy white; top of head and nose blackish brown, with a rather large patch of white or ochraceous-buff between eyes; sides of face mixed brown and buff; sides of nose, lips, and chin, white, yellowish white, or ochraceous-buff; sides of neck warm

¹ Five specimens from Black Hills, S. Dak.

buff (the underfur ochraceous-buff); feet hazel or tawny; tail above, mixed hazel and chestnut-brown; beneath, blackish brown; underparts ochraceous-buff (bases of hairs brownish) varied with tawny along sides; rump and buttocks warm buff. *Dark phase* (specimen from Boulder County, Colo., altitude, 8,000 feet): Underfur cinnamon-buff becoming dark cinnamon on hinder back; entire body extensively mixed with dark chestnut-brown hairs, sparingly tipped on back with light buff; feet blackish brown shaded with tawny; light face-markings reduced.

Skull.—Very similar to that of *nosophora*, but averaging relatively narrower, especially rostrum and interorbital region; bullae smaller.

Measurements.—Adult male:¹ Total length, 600–650 (average 623); tail vertebrae, 182–220 (200); hind foot, 86–90 (88). Adult female:² 552–618 (579); 137–192 (171); 78–85 (81). *Skull*: Adult male:³ Condyllo-basal length, 86–92.5 (88.3); palatal length, 48.4–51.1 (49.5); postpalatal length, 33.5–36.5 (35.2); length of nasals, 36–41 (38.4); zygomatic breadth, 55.7–60 (57.9); breadth across mastoids, 39–43.4 (41.5); least interorbital breadth, 17.3–21.8 (19.2); breadth of rostrum, 18.9–20.8 (19.6); maxillary tooth row, 19.9–21.4 (20.5). Adult female:⁴ Condyllo-basal length, 78.3–85 (81.4); palatal length, 43.7–47.6 (45.7); postpalatal length, 30–33.3 (31.5); length of nasals, 32.5–35 (33.7); zygomatic breadth, 51.7–54.9 (53.3); breadth across mastoids, 37.5–40.5 (38.6); least interorbital breadth, 16.4–17.8 (16.9); breadth of rostrum, 17.3–18.3 (17.8); maxillary tooth row, 19.3–21.4 (20.2).

Remarks.—In studying the marmots of this and related races in Colorado several puzzling problems have been encountered, the material at present available being insufficient satisfactorily to work out the characters and exact relationships of the forms. The specimens exhibit considerable individual variation, and, in addition to the dark phase already described, a light phase, characterized by less yellowish underparts and white tips to the hairs above, occurs in the same localities with the normal phase. Specimens in this light phase are known from Meeker, North Park, and Boulder County (altitude 10,300 feet). They rather closely resemble *engelhardti* externally, except that the underfur and feet are paler; the skulls, however, are typical of *luteola*.

The series from Laramie Mountains, Wyo., is intermediate between *luteola* and *dacota*, the pelage averaging redder and the skulls relatively shorter and broader than in typical *luteola*. Most of this series have large ochraceous-buff face markings. The series from Sulphur Springs, Colo., shows intergradation with *warreni*, the

¹ Three specimens from southern Wyoming and northern Colorado.

² Six specimens from northern Colorado.

³ Four specimens from Laramie and Medicine Bow Mountains, Wyo., and Mount Lincoln, Colo.

⁴ Five specimens from northern Colorado.

specimens being considerably redder than typical *luteola*; the skulls, however, are typical.

Specimens examined.—Total number, 42, as follows:

Colorado: Boulder County (altitude 8,000–11,000 feet), 4;¹ Coulter, 1; Elk-head Mountains, 1; Estes Park, 1; Lake John, 1;² Longs Peak, 1; Meeker, 2;² Middle Park, 1; Mount Lincoln, 6;³ North Park, 1;⁴ Pikes Peak, 1;² Sheephorn Pass, 4;² Steamboat Springs (18 miles below), 2;² Sulphur Springs, 5.⁵

Wyoming: Laramie Mountains, 7; Riverside, 2; Sherman, 1; Woods P. O., 1.

MARMOTA FLAVIVENTRIS WARRENI HOWELL.

WARREN'S MARMOT.

(Pl. VI, fig. 4; Pl. XII, fig. 2).

Marmota flaviventer warreni Howell, Proc. Biol. Soc. Washington, XXVII, 1914, p. 16.

Type locality.—Crested Butte, Colo.

Distribution.—Western Colorado, from Garfield County south to Saguache County; exact limits of range unknown.

Characters.—Size large (equaling *dacota*); colors deep red with little buff; skull similar to that of *obscura*, larger than that of *dacota* or *luteola*.

Color.—General tone of upperparts hazel, the underfur at base between mouse gray and fuscous, succeeded by pinkish cinnamon or cinnamon; long hairs hazel subterminally, tipped with a small area of buffy white; top and sides of head dark chestnut or bay; sides of neck cinnamon-buff; underparts hazel, varied with ochraceous-tawny, becoming chestnut on lower abdomen and Sanford's brown on throat; lips soiled whitish, bordered with cream-buff or pinkish cinnamon; fore legs hazel, shading to auburn on feet; hind feet and toes hazel, varied with cinnamon; tail dark chestnut-brown at base, shading to hazel or tawny; under surface blackish chestnut-brown.

Skull.—(Known only from females): Larger than that of *dacota* with longer, slenderer rostrum and narrower palatal foramina; very similar to that of *obscura*, but averaging longer and relatively narrower.

Measurements.—Adult female (type): Total length, 565; tail vertebrae, 131; hind foot, 82. Skull:⁶ Adult female: Condyllo-basal length, 83.3–89.3 (average 85.9); palatal length, 47–49.3 (47.9); post-palatal length, 33.6–36.9 (35.5) length of nasals, 36.8–39.2 (38.1); zygomatic breadth, 57–59 (57.7); breadth across mastoids, 42.9–

¹ Two in collection Field Mus. Nat. Hist.

² Collection E. R. Warren, Colorado Springs, Colo.

³ Collection Mus. Comp. Zool.

⁴ Collection Colo. Mus. Nat. Hist.

⁵ Three in collection E. R. Warren; one in collection Amer. Mus. Nat. Hist.

⁶ Three specimens from Crested Butte and Mud Springs, Colo.

44.7 (43.7); least interorbital breadth, 19–21.2 (20.2); breadth of rostrum, 18.7–20.3 (19.6); maxillary tooth row, 14.9–20.5 (17.4).

Remarks.—This form most nearly resembles *luteola* in color, but is much redder (less yellowish). Its skull also is much larger, agreeing rather with that of *obscura*. It is known from only a few specimens and its range has not been definitely determined. It probably will be found throughout west-central Colorado and adjacent parts of Utah. In both size and color it differs markedly from *engelhardti*, but additional material may show that the two forms intergrade. Intergradation with *luteola* is indicated by a series of specimens from Sulphur Springs (referred to *luteola*), and with *obscura* by a specimen from Florida, Colo. (referred to *obscura*).

Specimens examined.—Total number, 11, as follows:

Colorado: Crested Butte, 4;¹ Cochetopa Pass (9 miles south), 1; Mud Springs, Garfield County, 5;² Sapinero, 1.

MARMOTA FLAVIVENTRIS OBSCURA HOWELL.

DUSKY MARMOT.

(Pl. II, fig. 2; Pl. VIII, fig. 4; Pl. XIV, fig. 4.)

Marmota flaviventer obscura Howell, Proc. Biol. Soc. Washington, XXVII, 1914, p. 16.

Type locality.—Wheeler Peak, 5 miles south of Twining, N. Mex. (altitude, 11,300 feet).

Distribution.—Upper slopes of high peaks in northern New Mexico and southern Colorado, from Pecos Baldy, N. Mex., north to Sierra Blanca, vicinity of Fort Garland, and to San Juan Range near Osier, Colo. (formerly in the Manzano and Datil Mountains, N. Mex.); occurs in Hudsonian and upper Canadian Zones from about 9,600 feet altitude to the summits of the peaks (13,300–13,700 feet).

Characters.—Size large (exceeding *dacota* and equaling *flaviventris*); sexes about same size; tail long; colors dark brown mixed with white, with relatively little of the buff or tawny shades of other races; face usually without white markings; skull similar to those of *warreni* and *dacota*.

Color.—*Adults:* General tone of upperparts dark brown, grizzled with white, becoming cinnamon on hinder back in some individuals; underfur clove brown succeeded by pinkish buff, shading in some specimens to pinkish cinnamon on hinder back and rump; long hairs dark chestnut-brown, finely grizzled with white; head and face dark chestnut-brown or black, grizzled with white on sides of face, rarely with a whitish band across nose; sides of nose, lips, and chin, white or buffy white; feet dark chestnut-brown often extensively mixed with white or buffy hairs, or sometimes cinnamon-buff shaded with dark brown; tail chestnut-brown, shading to blackish brown beneath;

¹ Three in collection E. R. Warren.

² Four in collection E. R. Warren; one in Amer. Mus. Nat. Hist.

underparts mixed dark chestnut-brown or blackish brown and pale buff (tulleul buff of Ridgway) in varying proportions, buff usually most pronounced in the median line; chin, and sometimes throat, shaded with tawny or bay. *Young* (Osier, Colo.): General tone above, clove brown (becoming slightly more tawny on hinder back) sparingly grizzled with white; underparts mixed blackish brown and light buff; tail snuff brown above, pale clove brown below; hind feet same color as under side of tail, overlaid with light buff.

Skull.—Similar to that of *dacota*, males about the same size or slightly smaller, females larger; nasals (in females) averaging longer; palatal foramina narrower; interpterygoid fossa broader; postorbital constriction narrow; similar to that of *warreni* but averaging shorter and relatively broader with slightly broader premaxillae.

Measurements.—Adult male:¹ Total length, 645–664 (average 655); tail vertebrae, 180–220 (204); hind foot, 90–92 (90.7). Adult female:¹ 630–670 (646); 180–220 (190); 88–90 (89.3). *Skull*: Adult male:² Condyllo-basal length, 88.3–90.8 (89.5); palatal length, 49.4–52.7 (51); postpalatal length, 34–35.2 (34.6); length of nasals, 36.4–38.4 (37.4); zygomatic breadth, 60.2–60.4 (60.3); breadth across mastoids, 41.5–41.7 (41.6); least interorbital breadth, 21–21.1; breadth of rostrum, 21.9–23.3 (22.6); maxillary tooth row, 19–19.8 (19.4). Adult female:³ Condyllo-basal length, 84.5–89.5 (87.7); palatal length, 48.4–50.3 (49.3); postpalatal length, 31.9–35.7 (34.2); length of nasals, 35.4–39 (37.5); zygomatic breadth, 59.4–60.6 (59.8); breadth across mastoids, 41–43.8 (42.7); least interorbital breadth, 20.4–22.3 (21.1); breadth of rostrum, 22.3–22.4; maxillary tooth row, 20–21.

Remarks.—This is the darkest and one of the largest of the races of *flaviventris*. In its dark colors and the absence of light face markings it somewhat resembles the *monax* group. It is closely related to *warreni* and probably intergrades with it, but material from southern Colorado is too scanty to show clearly its relationships. A badly worn skin without skull from "Fort Massachusetts" [=mountains near] has been in the National Museum collection for many years, but not until 1903 and 1904, when Vernon Bailey collected a fine series of adults in the Pecos River and Taos Mountains, N. Mex., was it possible to determine the characters of the species.

In a series of 12 specimens from Osier, Colo., in the San Juan Range, about half of the individuals are considerably paler above than in the typical form, being uniformly pinkish cinnamon grizzled with white, without prominent brownish markings. A badly worn specimen from Florida, Colo., is decidedly redder above, particularly on the head and feet, indicating apparent intergradation with

¹ Four specimens from New Mexico.

² Two specimens from Wheeler Peak, N. Mex.

³ Three specimens from Wheeler Peak and Pecos Baldy, N. Mex.

warreni. Strangely, however, the skull of this specimen is not like that of either *warreni* or *obscura*, but agrees well with that of *luteola*.

Several lower jaws and fragments of crania, found in a cave on the Manzano Mountains by Archibald Rea, and broken pieces of a skull secured by Dr. Walter Hough from a cave on the Tularosa River near Old Fort Tularosa (south slope of the Datil Range) indicate the former occurrence of this species in those ranges. The jaws from the Manzano Mountains agree essentially with recent material, but the fragment from the Tularosa River is not specifically identifiable.

Of the habits of this marmot, Vernon Bailey in his field notes says:

They live entirely in or among rocks and prefer open country, either in parks or above timber line. They often burrow under large boulders in the parks and meadows, but more often live in fathomless piles of broken rock piled along the base of cliffs, or in seams and crevices of the cliffs themselves.

Specimens examined.—Total number, 24, as follows:

Colorado: Osier, San Juan Mountains (altitude, 9,625 feet), 12;¹ Florida, La Plata County (altitude, 7,200 feet), 1;² "Fort Massachusetts" [probably from Sierra Blanca Peak], 1.

New Mexico: Pecos Baldy, 2; Truchas Peak, 2; Wheeler Peak, 4; Aqua Fria Peak, 2.

Cranial Measurements of the *Marmota flaviventris* Group.

No.	Species and locality.	Sex.	Condylo-basal length.	Palatal length.	Postpalatal length.	Length of nasals.	Zygomatic breadth.	Breadth across mastoids.	Least inter-orbital breadth.	Breadth of rostrum.	Maxillary tooth row.	Remarks.
<i>Marmota flaviventris flaviventris</i> .												
100532	Donner, Cal.....	♂	97.1	55	38.2	42.6	62.3	46.2	23	22.3	20.9	Adult.
4750	Fort Crook, Cal.....	♂	94	54	37.6	42.5	.....	44.4	21.2	23	20	Do.
203030	Mount Hood, Oreg.....	[♂?]	92.5	52.3	.....	.....	.....	41.1	22	23	19.5	Do.
80360	Crater Lake, Oreg.....	♂	87	48.7	33.7	37	58.4	40.7	19.2	19.6	20	Do.
191351	Donner, Cal.....	♂	86.2	48.7	34.5	37.2	.....	40.4	17.3	19.4	21	Do.
³ 11901	Glen Alpine Springs, Cal.....	♂	84.1	48.2	32.7	37	57.6	39.2	19	21.2	20.5	Do.
23951	Carson, Nev.....	♂	84.6	48.5	31.8	35.4	55.4	39.6	18.7	21.4	22.1	Do.
<i>Marmota flaviventris avara</i> .												
99759	Okanogan, British Columbia....	♂	85.7	47.9	34.8	37.6	56.7	42.2	19.5	20	19.3	Adult.
⁴ 917	Cascade, British Columbia....	♂	86.5	48.8	34	36.6	55.6	39.1	17.8	19.4	19	Do.
94343	Okanogan, British Columbia....	♂	78	43.3	31	33.2	52.7	37.6	18	16.8	17.8	Do.
178842	.....do.....	♂	76.4	42.6	30.3	31.5	52.5	38.6	17.1	17.3	19.1	Do.
⁴ 1107	Midway, British Columbia....	♂	79.4	44.6	30.8	33.5	.....	37.8	17.4	17	19	Do.
<i>Marmota flaviventris sierrae</i> .												
³ 15157	Cannell Meadows, Tulare County, Cal.....	[♂?]	85.5	47.8	34.3	36.6	57.3	40.7	18.5	20	20.2	Old.
³ 15165	Whitney Creek, Tulare County, Cal.....	♂	90.2	50.5	35	37	58.3	43.6	20.3	20	20.5	Adult.
42641	Mount Whitney, Cal.....	♂	79.1	44	30.8	32.6	52	37.5	17	17.4	20.2	Subadult.
41198	.....do.....	♂	84.5	48	32.4	39	54.6	41.5	17.8	17	20.2	Do.
42859	.....do.....	♂	82.1	46.3	32.2	37.4	55.2	39.3	18.1	18.2	20	Adult.
³ 15163	Whitney Meadow, Cal.....	♂	77.3	44.7	28.7	32	52.7	37	16.5	17.4	19	Old.
41950	Head San Joaquin River, Cal.....	♂	81	46	31	34.4	.....	37.9	18.7	18.6	19.5	Do.

¹ Collection Colo. Mus. Nat. Hist.
² Collection Amer. Mus. Nat. Hist.

³ Collection Mus. Vert. Zool., Univ. of California.
⁴ Collection Victoria Mem. Mus.

Cranial measurements of the *Marmota flaviventris* group—Continued.

No.	Species and locality.	Sex.	Condyllo-basal length.	Palatal length.	Postpalatal length.	Length of nasals.	Zygomatic breadth.	Breadth across mastic folds.	Least inter-orbital breadth.	Breadth of rostrum.	Maxillary tooth row.	Remarks.
<i>Marmota flaviventris parvula.</i>												
93689	Arc Dome, Toyabe Range, Nev.	♀	73	41	28.6	30.5	48.6	34.3	15.5	17.2	17.7	Adult.
93690	Jefferson, Toquima Range, Nev.	♀	71.3	39.4	27	29.4	49	34.2	15.6	17.4	18.6	Adult; type.
<i>Marmota flaviventris engelhardti.</i>												
157828	Beaver Mountains, Utah	[♀?]	80	46.1	30.7	34.6	54	37.5	17	17.8	19	Adult.
158978	do.		78.4	44.8	30.2	33	52.3	36.5	16.3	18	19	Do.
158500	Parawan Mountains, Utah	♀	76.8	43.5	29.5	31	52.8	37.7	18	18	18.8	Do.
<i>Marmota flaviventris nosophora.</i>												
168493	Ross Fork, Mont.	♂	86.7	47.7	34.2	35.1	55.7	41.3	17.8	19.5	20.1	Young adult.
156924	Sawtooth National Forest, Idaho	♀	90	50.3	35.5	38.5	59.5	43.1	19	19.6	19.5	Adult.
191363	Conant Creek, Idaho	♀	92.2	52.5	35.2	39.1	57.3	42	21	20.5	20.8	Young adult.
66709	Pryor Mountains, Mont.	♀	94.2	53	37.2	40.4	63.7	45	22.2	20	20.4	Adult.
168473	Bitterroot Valley, Mont.	♀	83.8	46.2	33.5	34.8	54.5	41.6	19.5	19.3	20.2	Do.
168472	do.	♀	78.2	42.5	31.8	30.8	54	37.6	19.2	18.7	20.3	Do.
168494	do.	♀	79	45.5	30	32.8	53.2	40	19.7	17	19.8	Adult; type.
<i>Marmota flaviventris dacota.</i>												
186474	Custer, S. Dak.	♂	89.4	50.8	35	38	59.5	43	21.8	22	21.5	Subadult; type.
65920	Bear Lodge Mountains, Wyo.	♀	95.7	52.2	38.2	41.1	61.3	44.7	23.2	23.3	21.7	Adult.
25529	Bridger Pass, Wyo.	♀	90.5	51	36.2	38.4	61.7	41.8	18.2	20.5	20.9	Do.
191365	Custer, S. Dak.	♀	83.5	47.6	31.8	34.1	56.7	40.6	20.7	20	20.1	Do.
191366	do.	♀	81.8	45.4	32.5	31.5	55.3	39.5	20	20.5	20.3	Do.
168884	Savoy, S. Dak.	♀	84.5	47.7	33	35	55.7	40.7	19.6	20.4	20.5	Do.
<i>Marmota flaviventris luteola.</i>												
186520	Medicino Bow Mountains, Wyo.	♂	87	48.4	33.5	36	55.7	40.6	17.3	19	21.4	Subadult type.
25523	Laramie Mountains, Wyo.	♂	87.8	49.5	35.5	37.3	60	43.4	20.2	19.6	19.9	Adult.
¹ 175	Mount Lincoln, Colo.	[♂?]	92.5	51.1	36.5	41	59.4	43	21.8	20.8	21	Old.
² 2279	Steamboat Springs, Colo.		85	47.6	33.3	34	54.9	40.5	17.4	17.7	21.4	Adult.
² 3998	Lake John, Colo.		81.3	45.3	31.7	33	54	39	16.4	17.7	19.3	Do.
139082	Coulter, Colo.	♀	78.3	43.7	30	34	52.3	38.5	16.5	17.3	19.5	Do.
<i>Marmota flaviventris warreni.</i>												
202937	Crested Butte, Colo.	♀	89.3	49.3	36.1	39.2	59	44.7	21.2	20.3	16.7	Adult; type.
² 134	do.		83.3	47.4	36.9	36.8	57	42.9	19	19.9	14.9	Adult.
² 2512	Mud Springs, Colo.	♀	85.1	47	33.6	38.2	57	43.4	20.3	18.7	20.5	Do.
<i>Marmota flaviventris obscura.</i>												
135504	Wheeler Peak, N. Mex.	♀	90.8	52.7	34	38.4	60.4	41.7	21	23.3	19	Adult.
133506	do.	♀	88.3	49.4	35.2	36.4	60.2	41.5	21.1	21.9	19.8	Do.
128750	Pecos Baldy, N. Mex.	♀	89.5	50.3	35	39	59.4	43.8	20.4	22.4	21	Do.
133505	Wheeler Peak, N. Mex.	♀	84.5	48.4	31.9	35.4	59.4	41	20.5	22.3	20	Do.
133507	do.	♀	88.1	49.3	35.7	38.2	60.6	43.3	22.3	22.3	20	Do.

¹ Collection Mus. Comp. Zool.² Collection E. R. Warren, Colorado Springs, Colo.**Marmota caligata Group.**

The *caligata* group includes three species: *M. caligata*, *M. olympus*, and *M. vancouverensis*.

External characters.—Size large;¹ tail long (about 27 to 33 per cent of total length); ears relatively small (actually smaller than those of

¹ Weight of 6 specimens as follows: 9 lbs. (2 ♀, *cascadensis*); 11 lbs. (♂, *cascadensis*); 11½ lbs. (♀, *olympus*); 15½ lbs. (♂, *oxytona*); 17 lbs. (old ♀, *cascadensis*).

M. monax); posterior pads on sole of hind foot subcircular and situated near edges of sole (see Pl. III, fig. 1); mammae:¹ P. $\frac{2}{2}$; A. $\frac{2}{2}$; I. $\frac{1}{4}$ = 10; colors mainly black and white, shaded with cinnamon-buff on hinder parts, or upperparts of solid colors—brownish drab, russet, or vandyke brown.

Cranial characters.—Skull with superior outline nearly straight (as in the other American groups); interorbital region and postorbital processes much as in the *flaviventris* group;² nasals narrowed posteriorly, usually about same width at posterior end as premaxillae or slightly narrower (wider in *olympus*); temporal ridges uniting in old age to form a pronounced sagittal crest; anterior portion of floor of basi-occipital nearly flat, bounded posteriorly by two low processes which unite at about middle of basi-occipital, continuing as a pronounced ridge to the foramen magnum; anterior portion often with two rather pronounced depressions on either side of the median ridge; palate beveled at posterior border (as in *flaviventris* group); interpterygoid fossa relatively narrow (compared with *monax*); palatal foramina variable in shape; molar teeth similar to those of *monax*; maxillary tooth rows divergent anteriorly; anterior face of incisors ivory yellow to orange-buff.

Geographic distribution.—From the Endicott Range, Alaska—the most northerly range in the Rocky Mountains—and the Alaska Peninsula south to the Olympic Mountains and Mount Rainier, Wash., and the Bitterroot and Salmon River Mountains in central Idaho; also on Vancouver Island. Confined entirely to mountain sides at and above timberline except in the north, where the animals live in open meadows and descend to tide water. (See fig. 3.)

Remarks.—The members of this group may readily be distinguished by their greater size and their peculiar coloration—either mixed black and white or solid brownish. All of the races of *Marmota caligata* are colored much alike, differing mainly in relative proportions of black and white and in skull characters. *M. olympus*, isolated on the Olympic Peninsula, has developed a brownish drab coloration with relatively little black or white, and *M. vancouverensis*, dwelling on Vancouver Island, has lost all of the black and white colors and attained a dark seal brown pelage.

MARMOTA CALIGATA (ESCHSCHOLTZ).

[Synonymy under subspecies.]

External characters.—(See under *Marmota caligata* group, excepting color.)

Cranial characters.—(See under *Marmota caligata* group.)

Color.—Fore part of back mixed black and white in varying proportions, sometimes with a buffy or brownish tinge; hinder back similar, but usually strongly suffused with cinnamon-buff or pinkish

¹ As in *M. flaviventris*.

² Excepting *M. olympus*, which is relatively wider interorbitally.

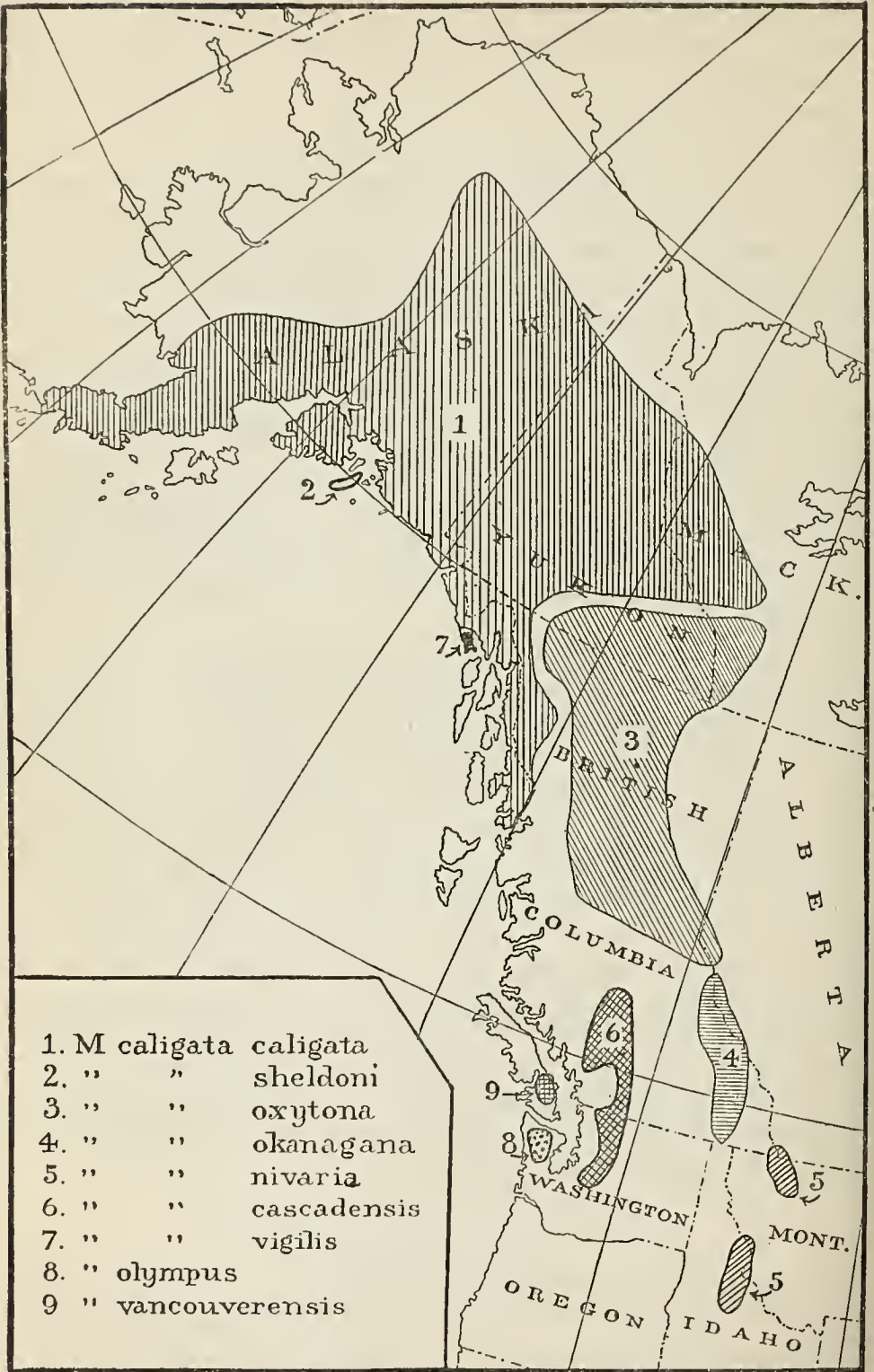


FIG. 3.—Distribution of the *Marmota caligata* group. Boundaries of ranges of subspecies are in many places theoretical.

cinnamon, sometimes tinged with hazel or vandyke brown; underfur dark hair-brown, bone brown, clove brown, bister, mouse gray, fuscous, or fuscous-black; sides of head and neck cinnamon, ochraceous-cinnamon, vandyke brown or blackish brown, more or less mixed with white or buffy white; borders of nose, lips, and chin soiled whitish; top of head and face black or blackish brown; face in front of and between eyes more or less extensively marked with white; legs usually same color as back; feet black or blackish brown, the front feet often with white markings, the hind feet mixed with cinnamon; tail above, cinnamon, pinkish cinnamon, cinnamon-buff, clay color, chestnut-brown, or bay, often mixed with hazel or vandyke brown; beneath, chestnut-brown, clove brown, blackish brown, or hessian brown, mixed with hazel, bay, or ochraceous-tawny; underparts white, grayish white, or clay color, varied with cinnamon, cinnamon-buff, or blackish brown.

Geographic distribution.—From the Endicott Range and the Alaska Peninsula, Alaska, south to Mount Rainier, Wash., and the Bitterroot and Salmon River Mountains, Idaho.

MARMOTA CALIGATA CALIGATA (ESCHSCHOLTZ).

NORTHERN HOARY MARMOT.

(Pl. IV, fig. 6; Pl. IX, fig. 4; Pl. XV, fig. 3.)

Arctomys pruinosus Richardson, Zool. Jour., III, 1828, p. 518. (Not of Gmelin.¹)

Arctomys caligata Eschscholtz, Zool. Atlas, Part II, 1829, p. 1, Plate VI.

Arctomys pruinosus Richardson, Fauna Boreali-Amer., I, 1829, p. 150; Baird, Mamm. N. Am., 1857, p. 345; Allen, Mon. N. Am. Rodentia, 1877, p. 924. (Not of Gmelin.)

Arctomys caligatus Tyrrell, Proc. Canadian Inst., 3rd Ser., VI, 1888, p. 88.

Marmotta caligata Allen, Bul. Amer. Mus. Nat. Hist., XIX, 1903, p. 539.

Marmota caligata MacFarlane, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 751.

Type locality.—Bristol Bay, Alaska.

Distribution.—Alaska and Yukon, from the Portland Canal north on the coast to Bristol Bay, and in the interior to the Endicott Range and the mountains lying westward of Fort Good Hope, Mackenzie.

Characters.—Size medium (for the group); colors moderately white; skull relatively short and broad.

Color.—General tone of upperparts white, moderately tipped with black, becoming cinnamon-buff on hinder back and rump; underfur at base fuscous or dark mouse gray (shading on hinder back to bister), succeeded on fore back by a broad area of white which gradually shades to cinnamon-buff on hinder back (in some

¹ *Arctomys pruinosus*, Gmelin, Syst. Nat., I, 1788, p. 144—based on the hoary marmot of Pennant. A careful comparison of Pennant's description with specimens of the several American species leads to the conclusion that this species is unidentifiable; the name *pruinosus* is therefore rejected.

specimens underfur between shoulders white to roots); top of head and face black, with a white patch in front of eyes often covering the whole face; black of crown usually extending from ear back over shoulders in the form of two divergent (more or less indistinct) stripes; sides of face mixed brown and white (often nearly white); fore legs white or buffy white, hind legs pale cinnamon-buff; fore and hind feet black or blackish brown; tail above, cinnamon-buff, tipped with blackish brown or bay, the bases of the hairs extensively dark chestnut-brown (or sometimes natal brown); beneath, blackish brown or chestnut-brown, sometimes tinged with hazel or ochraceous-tawny; underparts soiled whitish, sometimes mixed with black or blackish brown.

Skull.—Relatively short and broad with short, broad rostrum; zygomata broadly expanded posteriorly; nasals long, extending beyond ends of premaxillae; postorbital constriction rather broad.

Measurements.—Adult male:¹ Total length, 710–715; tail vertebrae, 210–218; hind foot, 91–105. Adult female:² 675; 190; 95. *Skull*: Adult male:³ Condyllo-basal length, 96.5–100.6 (average 98.7); palatal length, 55.7–57.4 (56.4); postpalatal length, 36.5–38.2 (37.4); length of nasals, 38.4–42.3 (40.7); zygomatic breadth, 64.5–68 (66.3); breadth across mastoids, 44–46.2 (44.4); least interorbital breadth, 24.3–27.6 (25.8); breadth of rostrum, 23.7–26.1 (24.6); maxillary tooth row, 22–23.8 (22.6). Adult female:⁴ Condyllo-basal length, 92.8–96.4 (94.2); palatal length, 53–54.8 (53.8); postpalatal length, 35–38 (36.3); length of nasals, 38–39.7 (38.8); zygomatic breadth, 61.6–64.1 (62.7); breadth across mastoids, 40–43.3 (41.9); least interorbital breadth, 23–25 (23.9); breadth of rostrum, 22.1–24.5 (23.2); maxillary tooth row, 20.6–22.5 (21.7).

Remarks.—This race has an extensive distribution in Alaska and Yukon and shows little variation over its whole range. In the southern part it is confined to the region near the coast but in the north it occupies the interior mountain ranges as far east as the main Rocky Mountains in northwestern Mackenzie. In specimens from the Kenai Peninsula the nasals average somewhat shorter than in typical specimens, rarely extending back of the posterior ends of the premaxillae, but the skulls show no other differences. Specimens from the southern coast of Alaska as far south as the Portland Canal (with the exception of the *vigilis* series from Glacier Bay) are typical, but intergradation with *oxytona* occurs a short distance from the coast in northern British Columbia, the series from Cheonee Mountains being distinctly intermediate in character. The form occupying the northern Rockies in eastern Yukon and western

¹ Two specimens from head of Coal Creek, Yukon.

² One specimen from same locality.

³ Five specimens from Becharof Lake, Alaska.

⁴ Seven specimens: 6 from Alaska Peninsula, 1 from Coal Creek, Yukon.

Mackenzie is provisionally referred to this race, no skulls from this entire region being available.

Specimens examined.—Total number, 102, as follows:

Alaska: Aleknagik Lake, 2; Becharof Lake, 12; Cape Elizabeth, 8; Charlie River (near head), 1; Chickamin River (Behm Canal), 2;¹ Cordova Bay, 3;¹ Disenchantment Bay, 1;¹ Fort Yukon, 1;² Hinchinbrook Island, 4; Juneau, 4; Kanatak, Portage Bay, 1; Kenai Mountains, 10;¹ Kenai Peninsula, 4; Mount McKinley, 1; Portage Bay, 5; Port Snettisham, 2;¹ Seldovia, 7;³ Toklat River (near head), 1; Valdez Narrows, 1;¹ White Pass, 4; Yakutat Bay, 2; no specific locality, 2.

British Columbia: Bennett, 2; Cheonee Mountains, 15.³

Mackenzie: Fort Good Hope (mountains west of), 1.

Yukon: Coal Creek (head) 4; Kalzas Creek, Pelly River, 2.

MARMOTA CALIGATA VIGILIS HELLER.

GLACIER MARMOT.

Marmota vigilis Heller, Univ. of California Pub. Zool., V, 1909, p. 248.

Type locality.—West shore of Glacier Bay, Alaska.

Distribution.—Known only from type locality.

Characters.—Similar in size and skull characters to *caligata*; variable in color, but constantly darker than *caligata*, with a strong tendency to run to blacks and browns; top of head and hind feet always brown (except in purely melanistic individuals); underparts darker.

Color.—*Normal fresh pelage* (June 12): Upperparts soiled whitish with a buffy tinge; underfur clove brown at roots, sparingly mixed with dull brown or black; hinder back shading to cinnamon-buff, darkest on rump and hind legs, extensively tipped with blackish brown; underparts dull clay color mixed with grayish white; nose, top of head, and feet blackish brown; sides of face mixed cinnamon-buff and blackish brown; tail above, mixed clay color and chestnut-brown; beneath, blackish chestnut-brown shading to hessian brown in anal region. *Variation:* The above description is based on the lightest and apparently most normally colored individual in the series of topotypes. Between this phase and the pure black phase are found numerous intermediate specimens, some as white beneath as *caligata* and as dark above as *oxytona*, while others are solid blackish brown very similar to *M. vancouverensis*, but slightly blacker; the hind feet and usually the tail are blackish brown; fore feet black or very dark brown.

Skull.—Not appreciably different from that of *caligata*.

Measurements—Adult male:⁴ Total length, 630–745 (average, 676); tail vertebrae, 197–210 (205); hind foot, 92–102 (97). Adult female:⁵ 620–680 (652); 170–212 (191); 90–95 (92). *Skull:* Adult male:⁵ Condyllo-basal length, 97.2–98.4 (97.6); palatal length, 54.7–55.8 (55.3);

¹ Collection Mus. Vert. Zool., Univ. of California.

² Collection Mus. Comp. Zool.

³ Collection Amer. Mus. Nat. Hist.

⁴ Five specimens from type locality.

⁵ Three specimens from type locality.

postpalatal length, 36.7–38 (37.5); length of nasals, 38.9–41.5 (40.6); zygomatic breadth, 62–67.7 (64.8); breadth across mastoids, 43.2–44.6 (43.8); least interorbital breadth, 22.6–26 (24.3); breadth of rostrum, 21.1–23.5 (22.2); maxillary tooth row, 21.8–22.5 (22.2). Adult female: ¹ Condyllo-basal length, 93.7; palatal length, 51.6; postpalatal length, 37.7; length of nasals, 39.6; zygomatic breadth, 61.8; breadth across mastoids, 42.3; least interorbital breadth, 24.5; breadth of rostrum, 21.3; maxillary tooth row, 22.

Remarks.—This form is apparently an incipient species or race in which the characters have not as yet become fixed. It shows the same tendency to become brown that appears so strikingly in *M. Vancouverensis*, and to a lesser degree in *M. olympus*. Its range is apparently limited to the region about Glacier Bay (since specimens from Yakutat Bay, White Pass, and Juneau are referable to *caligata*) but whether it is actually isolated is not known.

Specimens examined.—Ten, from type locality.²

MARMOTA CALIGATA SHELDONI HOWELL.

MONTAGUE ISLAND MARMOT.

Marmota caligata sheldoni Howell, Proc. Biol. Soc. Washington, XXVII, 1914, p. 18.

Type locality.—Montague Island, Alaska.

Distribution.—Known only from type locality.

Characters.—Similar to *caligata*, but size smaller and nasals shorter.

Color.—Upperparts mixed white and black, whitest on fore back, shading to cinnamon-buff on rump; underfur fuscous, shading on hinder back to natal brown; top of head black; a large white patch on face in front of eyes; sides of face mixed blackish brown and cinnamon; tail deep cinnamon-buff or ochraceous-buff, mixed with black, the bases of hairs chestnut-brown; underparts white, tinged with cinnamon.

Skull.—Similar to that of *caligata*, but decidedly smaller; nasals shorter and broader posteriorly, terminating usually about on a line with ends of premaxillae; premaxillae narrower.

Measurements.—Adult male topotype: Total length, 670; tail vertebrae, 185; hind foot, 94. Adult female topotype: 640; 180; 90. *Skull:* Adult male: ³ Condyllo-basal length, 89.5–96.6 (average, 93.6); palatal length, 51.2–55.4 (53.3); postpalatal length, 34.3–37 (35.5); length of nasals, 35–39 (37.3); zygomatic breadth, 61.5–63.4 (62.4); breadth across mastoids, 41.3–42.4 (41.9); least interorbital breadth, 22.5–23.8 (23.3); breadth of rostrum, 20.5–21.8 (21.2); maxillary tooth row, 22.2–23.1 (22.5). Adult female: ¹ Condyllo-basal length, 88.7; palatal length, 50.2; postpalatal length, 34; length of nasals, 37; zygomatic breadth, 59.4; breadth across mastoids, 39.7; least

¹ One specimen from type locality.

² Seven in collection Mus. Vert. Zool., Univ. of California.

³ Four specimens from type locality.

interorbital breadth, 22.2; breadth of rostrum, 20.5; maxillary tooth row, 21.8.

Remarks.—This race is a small form of *caligata*, confined to Montague Island, and differing from the typical race in size and skull characters. On Hinchinbrook Island, separated from Montague Island by only a narrow channel, the typical form is found.

Specimens examined.—Seven, from type locality.¹

MARMOTA CALIGATA OXYTONA HOLLISTER.

ROBSON HOARY MARMOT.

(Pl. III, fig. 1; Pl. IV, fig. 3; Pl. IX, fig. 2; Pl. X, fig. 4.)

Marmota sibilata Hollister, *Smiths. Misc. Coll.*, Vol. 56, No. 35, 1912, p. 1. (Not *Arctomys sibilata* Wolf.)

Marmota oxytona Hollister, *Science, N. S.*, XXXIX, No. 998, Feb. 13, 1914, p. 251 (new name for *Marmota sibilata* Hollister).

Type locality.—Head of Moose Pass branch of Smoky River, Alberta (altitude, 7,200 feet).

Distribution.—Interior of northern British Columbia, southwestern Mackenzie (?), and southern Yukon, from Teslin Lake and Liard River south to Barkerville, British Columbia, and the Mount Robson region, British Columbia and Alberta.

Characters.—Colors much blacker and tail darker than in *caligata*; skull larger and relatively narrower; males but little larger than females.

Color.—Upperparts as in *caligata*, but more extensively tipped with black, the underfur fuscous, shading to deep mouse gray or fuscous-black; hinder back dark cinnamon-buff, tinged with hazel and heavily mixed with black; top of head black with rather small white patches; cheeks ochraceous-cinnamon, varying to buffy white; tail above, dark cinnamon-buff mixed with bay, the bases of the hairs chestnut-brown or blackish brown; beneath, blackish brown, tinged with bay; underparts soiled whitish mixed with dull cinnamon, the bases of the hairs blackish brown.

Skull.—Much longer and relatively narrower than that of *caligata*, with long rostrum; zygomatic arch longer and distance from squamosal arm to tip of post-orbital process greater; nasals terminating on a line with ends of premaxillae or slightly posterior; interpterygoid fossa relatively narrower.

Measurements.—Adult male:² Total length, 720–775 (average, 747); tail vertebrae, 210–235 (221); hind foot, 100–110 (105.6). Adult female:³ 720–740 (730); 210; 95–105 (100). *Skull:* Adult male:⁴

¹ Five in collection Mus. Vert. Zool., Univ. of California.

² Five specimens from British Columbia (Mount Robson to Thudade Lake).

³ Two specimens from Sustut Mountains, British Columbia; and head of Smoky River, Alberta.

⁴ Seven specimens from northern British Columbia.

Condyllo-basal length, 101–107.4 (103.6); palatal length, 57–62.5 (58.9); postpalatal length, 38.3–41.7 (40.1); length of nasals, 41.5–45.3 (43.2); zygomatic breadth, 62.8–67.4 (65.8); breadth across mastoids, 44.2–48.3 (46.6); least interorbital breadth, 24–25.8 (25.3); breadth of rostrum, 22–24.8 (23.1); maxillary tooth row, 22–23.5 (22.8). Adult female:¹ Condyllo-basal length, 101.8–104.6 (103.2); palatal length, 56.5–61.2 (58.9); postpalatal length, 36.4–41.1 (38.8); length of nasals, 41–43.6 (42.3); zygomatic breadth, 65.3–66.2 (65.8); breadth across mastoids, 45.9–47.3 (46.6); least interorbital breadth, 25.4–26.7 (26); breadth of rostrum, 23–23.3; maxillary tooth row, 22.7.

Remarks.—This is the darkest and one of the largest of the races of *caligata*. It intergrades with *caligata* in northern British Columbia and southern Yukon, and with *okanagana* in southern British Columbia, but the material at present available is not sufficient to show the exact limits of its range. Specimens from the Liard River (Fort Halkett and Fort Liard) are provisionally referred to this race, no skulls from this region being available and the skins being rather indeterminate in characters. Additional material from the northern Rockies may extend the known range of this form farther northward in the interior.

A series from near Teslin Lake, Yukon, is intermediate between *caligata* and *oxytona*; the skulls are smaller than those of typical *oxytona*, some of them even smaller than those of *caligata*, but relatively narrower. The nasals, though actually longer than in *caligata*, do not extend so far back of the ends of the premaxillae, in this character agreeing with *oxytona*.

Specimens examined.—Total number, 63, as follows:

Alberta: Smoky River (near Moose Pass), 2.

British Columbia: Babine (mountains near), 3; Barkerville, 5; Finlay River (mountains near head), 1; Fort Halkett, 1;² Klappan River (mountains near), 3; Laurier Pass, 1; Level Mountain, 1;³ McConnell Creek (near Sustut Mountains), 1; Moose Pass, 2; Moose River (north fork), 2; Sheslay River, 2;³ Stuart Lake, 2; Sustut Mountains, 4; Thudade Lake, 2.

Mackenzie: Fort Liard, 2.

Yukon: Teslin Lake (mountains near), 29.⁴

MARMOTA CALIGATA OKANAGANA (KING).

OKANAGAN HOARY MARMOT.

(Pl. X, fig. 3.)

*Arctomys okanaganus*⁵ King, Narr. Journ. to Shores of Arctic Ocean, II, 1836, p. 236.

Arctomys pruinosis, Audubon and Bachman, Quad. N. Am., III, 1854, p. 17, Plate CIII. (Not of Gmelin.)

[*Marmota*] *okanagana* Howell, Proc. Biol. Soc. Washington, XXVII, 1914, p. 17 (type locality fixed).

¹ Two specimens from head of Smoky River, Alberta.

² Collection Univ. of Michigan.

³ Collection Amer. Mus. Nat. Hist.

⁴ Collection Victoria Mem. Mus.; approaching *caligata*.

⁵ "*Arctomys okanaganii*" on plate.

Type locality.—Gold Range, British Columbia.

Distribution.—Gold and Selkirk Ranges, British Columbia, and probably main range of the Rocky Mountains in Alberta from Banff to Henry House; exact limits unknown.

Characters.—Similar in color to *oxytona*, but averaging a little whiter; skull similar to that of *caligata*.

Color.—Upperparts much as in *oxytona*, but averaging whiter (some specimens almost as pale as *caligata*, but tail darker); underfur fuscous, shading to clove brown; fore back white, hinder back cinnamon-buff, more or less overlaid with black; sides of face cinnamon mixed with white; feet blackish brown, the hind feet grizzled with cinnamon; tail above, deep cinnamon (sometimes mixed with hazel) bordered with blackish brown, the bases of the hairs light chestnut-brown; beneath, blackish brown or dark chestnut-brown; underparts soiled whitish mixed with dull cinnamon.

Skull.—Similar to that of *caligata*, but averaging slightly larger, with narrower rostrum and postorbital constriction; nasals shorter, usually terminating little if any posterior to ends of premaxillae. Compared with *oxytona*: Decidedly shorter and relatively broader; braincase less elongated and distance from tip of postorbital process to squamosal arm of zygoma much less.

Measurements.—Adult male:¹ Total length, 670–754 (average, 694); tail vertebrae, 202–218 (212); hind foot, 91–106 (98). Adult female:² 659–735 (695); 202–224 (212); 93–103 (94). *Skull*: Adult male:³ Condyllo-basal length, 95–100 (97.7); palatal length, 53.4–57.4 (55.5); postpalatal length, 37–38.1 (37.8); length of nasals, 37–40.5 (38.9); zygomatic breadth, 64.8–67 (66.2); breadth across mastoids, 45.2–46 (45.6); least interorbital breadth, 24.9–27 (25.7); breadth of rostrum, 23–25.2 (24.2); maxillary tooth row, 21.9–22.7 (22.4). Adult female:⁴ Condyllo-basal length, 94.4–97.6 (96.4); palatal length, 53.5–55.3 (54.5); postpalatal length, 36–38.7 (37.3); length of nasals, 38–40.3 (39); zygomatic breadth, 62.2–66.3 (64.4); breadth across mastoids, 42.2–45.5 (43.7); least interorbital breadth, 21.9–24.9 (23.7); breadth of rostrum, 21–23.3 (21.9); maxillary tooth row, 21.4–22.4 (22).

Remarks.—This race apparently has a rather limited distribution, but its characters are well marked. It is not in any way intermediate between *oxytona* and *nivaria*, as might be expected from its geographic position, for, while it agrees with the former in color, its skull is much smaller than in either and more nearly resembles that of *caligata*. It is very much darker in color than *nivaria*, the differences being especially noticeable in the young.

¹ Four specimens from Selkirk Range, British Columbia.

² Six specimens from same localities.

³ Three specimens from Glacier and Nelson, British Columbia.

⁴ Five specimens from same localities.

King, in naming the species in 1836, gave an excellent description and figure of the animal, based on two living individuals which had been brought from the Okanogan region to Norway House, Canada. These were later presented by King to the Zoological Gardens in London, where they were seen by Audubon, and after the death of the animals the skins served as the basis of the figure of the hoary marmot in his "Quadrupeds of North America." The type specimen, as I am informed by Oldfield Thomas, is still in the British Museum collection (No. 55.12.24.126) and agrees in every detail with the original description. The skull probably (not certainly) belonging to the skin is so diseased by menagerie life as to be of no use for comparison.

The original description is so complete and agrees so well with the form occurring in the Selkirks that I have no hesitation in fixing the type locality in the Gold Range—the first range to the eastward of Shuswap Lake—where it is likely the type was secured.¹

Specimens examined.—Total number, 18, as follows:

Alberta: Henry House (mountains 15 miles south), 2.

British Columbia: Field, 2;² Glacier, 7; Spillimacheen River, 3;³ Toad Mountain (6 miles south of Nelson), 4.

MARMOTA CALIGATA NIVARIA HOWELL.

MONTANA HOARY MARMOT.

(Pl. X, fig. 2; Pl. XII, fig. 4.)

Marmota caligata nivaria Howell, Proc. Biol. Soc. Washington, XXVII, 1914, p. 17.

Type locality.—Mountains near Upper St. Marys Lake, Mont. (altitude, 6,100 feet).

Distribution.—Upper slopes (at and above timberline) of high mountains of northwestern Montana and of Bitterroot and Salmon River Mountains, Idaho (limits of range imperfectly known).

Characters.—Whitest member of the group, being very much whiter than either *okanagana* or *oxytona*; similar in size and skull characters to *oxytona*.

Color.—*Adults:* Fore part of back (to middle) snowy white, sparingly grizzled with black, the underfur dark hair-brown; hinder back pinkish cinnamon or cinnamon-buff mixed with black and white, the underfur bone brown; top of head black, much mixed with white and with a large white patch across face in front of eyes; sides of face brownish, mixed with white and cinnamon-buff; fore feet black with

¹ King defines the type region as follows: "In a small tract of country, on the borders of the Rocky Mountains, lying between the Columbia and Fraser Rivers, these animals are found in abundance, supplying with food and clothing the Okanagan Indians, whose territory is bounded to the north by the Seechwap Lake, and to the south by the Spokane River * * *." (King, R. Narr. Journ. to Shores of Arctic Ocean, II, 1836, p. 241.)

² Collection Victoria Mem. Mus.

³ Collection Amer. Mus. Nat. Hist.

white patches; hind feet black, more or less mixed with cinnamon; underparts white, sparingly mixed on abdomen with cinnamon-buff; tail above, mixed pinkish cinnamon and chestnut-brown; beneath clove brown or blackish brown. *Young* (specimen from Elk Summit, Idaho): Nearly pure white above, shading to cinnamon-buff on hinder back; the underfur dark mouse gray; tail cinnamon-buff fringed at tip with blackish brown, the bases of hairs hair-brown; feet and top of head fuscous-black.

Skull.—(Known only from females.) Closely similar to that of *oxytona*, possibly averaging a little shorter; much larger and relatively narrower than that of *okanagana*, with broader rostrum.

Measurements.—Young adult male from type locality: Total length, 755; tail vertebrae, 250; hind foot, 110. Adult female:¹ 700–820 (average, 751); 200–245 (224); 95–113 (105). *Skull*: Adult female:¹ Condyllo-basal length, 99.5–106.5 (102); palatal length, 58–61.4 (59.4); postpalatal length, 37.5–39.6 (38.2); length of nasals, 40.6–43.9 (42.2); zygomatic breadth, 64–66.6 (65.7); breadth across mastoids, 44.8–45.7 (45.5); least interorbital breadth, 23.3–27.2 (25.5); breadth of rostrum, 21.6–25 (23); maxillary tooth row, 22.2–24.4 (22.9).

Remarks.—This race widely differs in color from its nearest relatives, *okanagana* and *oxytona*, being even whiter than *caligata*. The characters are strikingly shown by young specimens which are almost pure white except on the hinder back and tail. Additional material is needed to determine the exact range of the form and the cranial characters of the males.

Specimens examined.—Total number, 14, as follows:

Idaho: Bitterroot Mountains (headwaters of Clearwater River), 3; Elk Summit, Salmon River Mountains, 2.

Montana: Upper St. Marys Lake (mountains near), 9.

MARMOTA CALIGATA CASCADENSIS HOWELL.

CASCADE HOARY MARMOT.

(Pl. X, fig. 1; Pl. XV, fig. 4.)

Marmota caligata cascadenensis Howell, Proc. Biol. Soc. Washington, XXVII, 1914, p. 17.

Type locality.—Mount Rainier, Wash. (altitude, 6,000 feet).

Distribution.—Cascade Range (at and above timberline) from Mount Rainier, Wash., north to southern British Columbia.

Characters.—Size large (equaling *olympus* and *oxytona*; larger than *caligata*); color similar to that of *caligata*, but head and feet usually browner and underparts darker; skull similar to that of *oxytona* but relatively broader, much larger than that of either *caligata* or *okanagana*.

¹ Four specimens from type locality.

Color.—Fore part of back white or creamy white, sparingly tipped with vandyke brown, the bases of the hairs with a broad area of the latter color; hinder back more extensively shaded with brown and sometimes tinged with cinnamon-buff; head and face vandyke brown or blackish brown, often with a white patch in front of eyes; sides of face and neck brownish, tinged with cinnamon or buffy white; feet blackish brown, often mixed with cinnamon; tail cinnamon-buff mixed with vandyke brown, becoming (in some specimens) dark chestnut-brown below; underparts mixed grayish white and blackish brown in varying proportions, faintly tinged with pale cinnamon-buff.

Skull.—Similar to that of *oxytona*, but relatively broader across zygomata and interorbital region; decidedly larger than that of its nearest neighbor, *okanagana*, with broader postorbital constriction; compared with *nivaria* it is shorter, with the zygomata more widely expanded and the premaxillae narrower.

Measurements.—Adult male:¹ Total length, 710–785 (average, 749); tail vertebrae, 205–252 (232); hind foot, 98–112 (102). Adult female:² 680–765 (714); 195–247 (219); 94–107 (99). *Skull*: Adult male:³ Condylar-basal length, 106.2–107 (106.6); palatal length, 61.6–62.7 (62.2); postpalatal length, 39–40 (39.5); length of nasals, 42–44.5 (43.3); zygomatic breadth, 69.2–69.8 (69.5); breadth across mastoids, 48.5–49.2 (48.9); least interorbital breadth, 27.1–29 (28); breadth of rostrum, 24.5–24.7 (24.6); maxillary tooth row, 22.3–24.1 (23.2). Adult female:⁴ Condylar-basal length, 95.4–102.5 (98.8); palatal length, 56.3–59 (57.7); postpalatal length, 34.6–39 (37.7); length of nasals, 37.8–44 (41.7); zygomatic breadth, 64.2–68.4 (65.8); breadth across mastoids, 44.9–49.4 (46.7); least interorbital breadth, 22.5–24.6 (23.8); breadth of rostrum, 19.3–22.7 (21.2); maxillary tooth row, 21–23.2 (22.1).

Remarks.—The Cascade hoary marmot differs from both *okanagana* and *oxytona* in whiter and browner (less black) coloration above; from *nivaria* in much more dusky colors, both above and below; and from *caligata* in much larger size and darker coloration. It is widely different from *olympus*, both in color and cranial characters. It is apparently isolated from all the other forms of the group, and no absolute intergrades have been examined, but the characters separating it from the forms of *caligata* are so slight that it seems best to regard it as a subspecies of the latter.

¹ Four specimens from Mount Rainier and Cascade River, Wash.

² Six specimens from same localities.

³ Two specimens from Cascade River, Wash., and Mount Baker Range, British Columbia.

⁴ Seven specimens from Cascade Range, Wash., and Mount Baker Range, British Columbia.

Specimens examined.—Total number, 50, as follows:

British Columbia: Chilliwack (mountains near), 1;¹ Hope, 1;² Howe Sound (near head), 3;¹ Mount Baker Range (near United States boundary), 8;³ Skagit River (mountains near head), 6; Spences Bridge, 1;⁴ Tammi Hy Mountain, 2.¹

Washington: Camp Chiloweyuck, 2; Cascade River (near head), 8; Easton (mountains near), 1; Mount Rainier, 7; "Northwest boundary survey" (probably Mount Baker Range), 10.

MARMOTA OLYMPUS (MERRIAM).

OLYMPIC MARMOT.

(Pl. II, fig. 1; Pl. IX, fig. 1; Pl. XV, fig. 1.)

Arctomys olympus Merriam, Proc. Acad. Nat. Sci., Philadelphia, 1898, p. 352.

[*Marmota*] *olympus* Trouessart, Cat. Mamm., Suppl., 1904, p. 344.

Type locality.—Head of Soleduck River, Olympic Mountains, Wash. (at timberline).

Distribution.—Upper slopes of the Olympic Mountains, Wash., above timberline (from about 4,000 feet altitude to near summits of peaks).

Characters.—Size large (about equaling *M. caligata cascadensis*); color in fresh pelage brownish drab mixed with white; feet brown; skull with broad rostrum and interorbital region.

Color.—*Fresh pelage:*⁵ General tone brownish drab, more or less mixed with white hairs; underfur between hair-brown and benzo brown, becoming pale drab-gray at tips; long hairs glossy blackish brown mixed with more or less pure white ones; top and sides of head blackish brown, with a broad, white patch in front of eyes; sides of nose, lips, and chin white; legs brownish drab shading to blackish brown on the feet; tail clove brown, tipped with light pinkish cinnamon; underparts brownish drab mixed with white (or solid soiled whitish). *Worn summer pelage:* General tone of upperparts pinkish buff, varied with russet, the bases of hairs bister; feet chestnut-brown; tail above, pinkish buff or cinnamon-buff, mixed with snuff brown; beneath, snuff brown to chestnut-brown. *Young* (half-grown August specimens): General tone of upperparts grayish brown, becoming cinnamon on rump; underfur hair-brown at base, tipped on fore back with white, and on hinder back and rump with cinnamon or cinnamon-buff; top and sides of head and fore legs bister; feet dark clove brown; underparts light clove brown mixed with white or pale buff.

¹ Collection Victoria Mem. Mus.

² Collection Mus. Comp. Zool.

³ Including five in Mus. Comp. Zool.

⁴ Collection Amer. Mus. Nat. Hist.

⁵ No specimens in full winter pelage have been seen; description from August specimens just beginning to acquire the fall pelage.

Skull.—Similar to that of *casca-**densis* but relatively narrower across zygomata and broader between orbits and across rostrum; postorbital constriction narrower; nasal branches of premaxillae narrower than nasals at posterior end.

Measurements.—Adult male:¹ Total length, 720–750 (average, 740); tail vertebrae, 210–237 (219); hind foot, 100–110 (106). Adult female:² 670–690 (680); 180–192 (186); 91–100 (95.5). *Skull*: Adult male:³ Condylö-basal length, 105–109.8 (106.1); palatal length, 60–63 (61.1); postpalatal length, 39.6–42 (40.6); length of nasals, 40.6–46 (43.7); zygomatic breadth, 64.8–67.1 (65.6); breadth across mastoids, 46.2–47.3 (47); least interorbital breadth, 27.5–31.2 (29.8); breadth of rostrum, 24.5–27.7 (25.8); maxillary tooth row, 21.5–24.2 (23.1). Adult female:⁴ Condylö-basal length, 99.5; palatal length, 58; postpalatal length, 37.5; length of nasals, 41.5; zygomatic breadth, 64.3; breadth across mastoids, 43.7; least interorbital breadth, 26.5; breadth of rostrum, 24.6; maxillary tooth row, 22.5.

Remarks.—The Olympic marmot is one of the largest members of the *caligata* group, about equaling in external measurements *casca-**densis* and *oxytona*. Its skull averages about the size of that of *casca-**densis*, but the largest male skull of *olympus* is longer than any other American marmot skull examined. In color the species is decidedly browner than any of the forms of *caligata*, though not nearly so brown as *vancouverensis*. The black colors of *caligata* have almost entirely disappeared, but some of the white hairs remain.

This species is confined to the high mountains of the Olympic Peninsula and is geographically isolated from its nearest relative, *casca-**densis*.

Specimens examined.—Total number, 17, as follows:

Washington: Happy Lake, Olympic Mountains, 7;⁵ Mount Ellinor, 3; Mount Steel, 4; Soleduck River (near head), Olympic Mountains, 3.

MARMOTA VANCOUVERENSIS SWARTH.

VANCOUVER ISLAND MARMOT.

(Pl. IX, fig. 3; Pl. XV, fig. 2.)

Marmota vancouverensis Swarth, Univ. of California Pub. Zool., VII, 1911, p. 201; X, 1912, p. 89.

Type locality.—Mount Douglas, Vancouver Island, British Columbia (altitude, 4,200 feet).

¹ Three specimens from Olympic Mountains, Wash.

² Two specimens from same locality.

³ Five specimens from same locality.

⁴ One specimen from same locality.

⁵ Collection Field Mus. Nat. Hist.

Distribution.—Vancouver Island, British Columbia; apparently not generally distributed, and known at present only from “the mountains at the head of China Creek, some 20 miles south of Alberni, in the Golden Eagle Basin, and King Solomon Basin, and on the surrounding slopes and ridges.”¹

Characters.—Size of *M. caligata cascadensis*; color uniformly dark brown; skull relatively narrow with peculiarly shaped nasals.

Color.—Entire body, legs, and tail dark vandyke brown, the underfur being of the same color, the long hairs more blackish and glossy; sides of nose and chin soiled whitish; underparts sometimes irregularly blotched with white, and back rarely with a few scattering white hairs; feet glossy blackish brown. In worn pelage the upperparts and tail fade to sayal brown or clay color.

Skull.—Similar to that of *cascadensis*, but smaller and relatively narrower; zygomata less widely expanded; premaxillae relatively wider; nasals deeply emarginate posteriorly, the frontals projecting forward and forming a V-shaped notch between nasals; incisors white or yellowish white.

Measurements.—Adult male:² Total length, 660–710 (average, 684); tail vertebrae, 200–300 (222); hind foot, 90–102 (98.4). Adult female:³ 680–720 (700); 210–240 (225); 100–105 (102.5). *Skull:* Adult male:⁴ Condyllo-basal length, 98–103.2 (99.9); palatal length, 57–59.5 (57.8); postpalatal length, 36.5–39.5 (37.8); length of nasals, 40–42.7 (41.4); zygomatic breadth, 64.2–65.5 (64.7); breadth across mastoids, 45.7–47 (46.1); least interorbital breadth, 23.2–24.4 (24); breadth of rostrum, 22–24 (22.9); maxillary tooth row, 23.6–24.7 (24.1). Adult female:³ Condyllo-basal length, 93.7–96.6 (95.2); palatal length, 54–54.3 (54.2); postpalatal length, 35.2–37.5 (36.3); length of nasals, 39–39.6 (39.3); zygomatic breadth, 61.6–62.6 (62.1); breadth across mastoids, 44; least interorbital breadth, 21.7–23 (22.3); breadth of rostrum, 21.5–21.6; maxillary tooth row, 23.1–23.7 (23.4).

Remarks.—This peculiar marmot, although clearly related to the mainland species (*caligata*) has, through isolation, developed striking characters, both external and cranial. The tendency of isolated coastal forms in this group to become brown (shown in a lesser degree by *M. caligata vigilis* and *M. olympus*) has reached the greatest extreme in this species, the black colors of the mainland forms being entirely lacking and the white reduced to scattering hairs.

¹ Swarth, H. S. Loc. cit., X, 1912, p. 89.

² Five specimens from vicinity of type locality.

³ Two specimens from vicinity of type locality.

⁴ Four specimens from vicinity of type locality.

After a season's exploration of the southern part of Vancouver Island, Swarth came to the conclusion that the species is probably confined to a small area in the vicinity of Mount Douglas. He states:

We found them in the mountains at the head of China Creek, some 20 miles south of Alberni, in the Golden Eagle Basin, and King Solomon Basin, and on the surrounding slopes and ridges. They were most abundant on Mount Douglas, the peak to the west of King Solomon's Basin. Wherever the ground was bare of timber, or but sparsely covered, as is the case over extensive areas at this point, the marmots had established themselves, burrowing under the rocks, and apparently never wandering very far from home. * * * Their extreme wariness is correlated with conspicuousness, for the dark brown pelage shows in marked contrast against either gray rocks or green grass. * * * They whistled but seldom, only one or two being heard during the three weeks we spent in their territory.¹

None was found in apparently suitable situations on Mount Arrow-smith, and certain timber cruisers who had explored the wilder parts of the island stated that they had never seen a marmot.

Specimens examined.—Total number, 11,² as follows:³

British Columbia: Golden Eagle Basin, 1; King Solomon Basin, 3; Mount Douglas, 7.

Cranial Measurements of the *Marmota caligata* Group.

No.	Species and locality.	Sex.	Condylar-basal length.	Palatal length.	Postpalatal length.	Length of nasals.	Zygomatic breadth.	Breadth across mastoids.	Least interorbital breadth.	Breadth of rostrum.	Maxillary tooth row.	Remarks.
<i>Marmota caligata caligata.</i>												
131440	Becharof Lake, Alaska	{♂?}	99	56.8	36.8	38.4	68	46.2	27.6	26.1	22	Adult.
131441	do.	{♂?}	96.5	55.7	36.5	41.4	64.7	44	24.3	24	22.3	Do.
131442	do.	{♂?}	100.6	57.4	38.2	42.3	67.8	44	25.8	24.1	23.8	Do.
95154	White Pass, Alaska	{♂?}	100	57.7	37.8	43	65.2	44.2	23.4	23.6	23.4	Do.
131444	Becharof Lake, Alaska	{♂?}	92.8	53	35.8	38	63.4	43.2	24.3	22.9	21.9	Do.
128069	do.	{♂?}	96.4	53.9	38	39.1	64.1	43	23.9	24.5	22.5	Do.
95153	White Pass, Alaska	{♂?}	88.9	51	33.5	40.5	57.5	40	22.1	20	22	Do.
135161	Head of Coal Creek, Yukon	♀	94	53.9	36	38	62.3	43.3	24	22.1	21.7	Do.
<i>Marmota caligata vigilis.</i>												
4418	Glacier Bay, Alaska	♂	97.2	55.8	36.7	38.9	62	43.5	22.6	21.1	22.3	Do.
4427	do.	♂	97.3	54.7	37.8	41.4	64.8	43.2	24.2	22	21.8	Do.
97952	do.	♂	98.4	55.5	38	41.5	67.7	44.6	26	23.5	22.5	Do.
97953	do.	♂	93.7	51.6	37.7	39.6	61.8	42.3	24.5	21.3	22	Do.
<i>Marmota caligata sheldoni.</i>												
137319	Montague Island, Alaska	♂	89.5	51.2	34.3	35	61.5	41.3	22.5	20.5	22.5	Do.
4962	do.	♂	96.6	55.4	36	39	63	42.3	23.5	21.6	23.1	Do.
4961	do.	{♂?}	96	54.5	37	38.8	63.4	42.4	23.8	21.8	22.4	Do.
4969	do.	{♂?}	92.3	52.2	34.8	36.4	61.5	41.5	23.2	21	22.2	Do.
4960	do.	♀	88.7	50.2	34	37	59.4	39.7	22.2	20.5	21.8	Do.

¹ Swarth, H. S. Univ. of California Publ. Zool., X, 1912, pp. 89-90.

² All in collection Mus. Vert. Zool., Univ. of California.

³ All about 20 miles south of Alberni, British Columbia, within a radius of 10 miles.

⁴ Collection Mus. Vert. Zool., Univ. of California.

Cranial measurements of the *Marmota caligata* group—Continued.

No.	Species and locality.	Sex.	Condyllo-basal length.	Palatal length.	Postpalatal length.	Length of nasals.	Zygomatic breadth.	Breadth across maxillae.	Least interorbital breadth.	Breadth of rostrum.	Maxillary tooth row.	Remarks.
<i>Marmota caligata oxytona.</i>												
175565	Moose Forks, British Columbia..	♂	101	57	40	41.5	62.8	44.2	25	23	22	Adult.
202789	Sustut Mountains, Brit. Col.....	♂	102	58.6	39.5	42.7	66.8	46.5	25.8	22.2	23	Do.
202791	Lake Thudade, Brit. Col.....	♂	107.4	62.5	40.2	45.3	67.4	48.3	25.7	23.6	23.3	Do.
¹ 20766	Level Mountain, Brit. Col.....	♂	105	59	41	42.3	66.5	47	25.7	24.8	22	Do.
174503	Head of Smoky River, Alberta..	♂	101.8	56.5	41.1	43.6	65.3	45.9	25.4	23	22.7	Do.
174502	.....do.....	♂	104.6	61.2	36.4	41	66.2	47.3	26.7	23.3	22.7	Do.
<i>Marmota caligata okanagana.</i>												
67073	Glacier, British Columbia.....	♂	95	53.4	37	37	66.8	45.5	24.9	23	22.7	Do.
67076	.....do.....	♂	100	57.4	37.3	40.5	67	46	27	25.2	22.5	Do.
66695	Nelson, British Columbia.....	♂	98.1	55.7	38.1	39.3	64.8	45.2	25.3	24.4	21.9	Do.
67072	Glacier, British Columbia.....	♂	96	54.4	37	40.3	64	43.7	23.5	21	22.1	Do.
67074	.....do.....	♂	97.6	55.3	38.7	38.6	66.3	45.5	21.9	21.9	21.4	Do.
67075	.....do.....	♂	94.4	53.3	36	38	65	42.9	24.6	23.3	22.3	Do.
<i>Marmota caligata nivaria.</i>												
72222	St. Marys Lake, Mont.....	♂	106.5	61.4	39.6	41.2	66.6	45.7	27.2	25	22.8	Do.
72223	.....do.....	♂	101	58	37.8	43.9	66.3	45.6	26.1	23.4	22.2	Do.
72225	.....do.....	♂	101	59	37.8	43	65.8	44.8	25.4	21.8	24.4	Do.
72235	.....do.....	♂	99.5	59	37.5	40.6	64	45.7	23.3	22	22.3	Do.
<i>Marmota caligata cascadenis.</i>												
6871	Washington - British Columbia boundary.	♂	107	62.7	40	44.5	69.2	48.5	27.1	24.7	24.1	Do.
42793	Head of Cascade River, Wash....	♂	106.2	61.6	39	42	69.8	49.2	29	24.5	22.3	Do.
² 6840	Mount Baker Range, Brit. Col....	♂	101	59	37.7	43.2	65.6	47.6	23.3	21.8	21	Do.
42792	Head of Cascade River, Wash....	♂	102.5	58.7	39	44	68.4	49.4	23.1	22.7	23.2	Do.
90133	Mount Rainier, Wash.....	♂	98.5	56.8	38	41.6	66.2	46.7	24.3	20.7	22.1	Do.
90134	.....do.....	♂	95.4	56.3	38.4	43.9	66.7	47.8	22.5	21	22.3	Do.
<i>Marmota olympus.</i>												
67611	Olympic Mountains, Wash.....	♂	105	60.2	40.2	44	64.8	47.3	27.5	24.6	22.9	Do.
92768	.....do.....	♂	105.3	61.8	39.6	43	65.1	47.3	31.2	26.3	21.5	Do.
³ 6235	.....do.....	♂	109.8	63	42	46	67.1	47.3	31.1	27.7	23.7	Do.
67612	.....do.....	♂	99.5	58	37.5	41.5	64.3	43.7	26.5	24.6	22.5	Do.
<i>Marmota vancouverensis.</i>												
⁴ 12099	Vancouver Island, Brit. Col.....	♂	98	57	37	40.5	64	47	24	23.7	23.7	Do.
⁴ 12092	.....do.....	♂	98.2	57.2	36.5	40	64.2	45.7	23.2	22	24.3	Do.
⁴ 12090	.....do.....	♂	100.4	57.7	38.2	42.4	64.5	46	24.4	22.6	23.6	Do.
⁴ 12091	.....do.....	♂	103.2	59.5	39.5	42.7	65.5	45.8	24.3	23.2	24.7	Do.
⁴ 12094	.....do.....	♂	93.7	54	35.2	39	61.6	44	21.7	21.5	23.7	Do.
⁴ 12100	.....do.....	♂	96.6	54.3	37.5	39.6	62.6	44	23	21.8	23.1	Do.

¹ Collection Amer. Mus. Nat. Hist.² Collection Mus. Comp. Zool.³ Collection Field Mus. Nat. Hist.⁴ Collection Mus. Vert. Zool., Univ. of California.

EXPLANATION OF PLATES.

PLATE II.

[Much reduced.]

- FIG. 1. *Marmota olympus*, ♂ adult, Olympic Mountains, Wash., (altitude 5,000 feet), Aug. 28, 1897. (No. 92768, U. S. Nat. Mus., Biological Survey collection.)
2. *Marmota flaviventris obscura*, ♂ adult, Wheeler Peak, N. Mex. (altitude 12,400 feet), July 27, 1904. (No. 133506, U. S. Nat. Mus., Biological Survey collection.)

PLATE III.

[Natural size.]

- FIG. 1. *Marmota caligata oxytona*. Klappan Mountain, British Columbia. (No. 170-683, U. S. Nat. Mus., Biological Survey collection.)
2. *Marmota flaviventris flaviventris*. Summer Lake, Oreg. (No. 89311, U. S. Nat. Mus., Biological Survey collection.)
3. *Marmota monax preblorum*. Woburn, Mass. (No. 78358, U. S. Nat. Mus., Biological Survey collection.)

PLATE IV.

[Three-fourths natural size.]

- FIG. 1. *Marmota flaviventris dacota*, ♂ adult, Bridger Pass, Wyo. (No. 25529, U. S. Nat. Mus., Biological Survey collection.)
2. *Marmota monax monax*, ♂ adult, Peaks of Otter, Va. (No. 143962, U. S. Nat. Mus.)
3. *Marmota caligata oxytona*, ♂ adult, Lake Thudade, British Columbia. (No. 202791, U. S. Nat. Mus., Biological Survey collection.)
4. *Marmota flaviventris sierrae*, ♀ adult, head of San Joaquin River, Cal. (No. 41950, U. S. Nat. Mus., Biological Survey collection.)
5. *Marmota monax rufescens*, ♂ adult, Lake George, N. Y. (No. 67695, U. S. Nat. Mus., Biological Survey collection.)
6. *Marmota caligata caligata*, [♂ ?] adult, Becharof Lake, Alaska. (No. 131437, U. S. Nat. Mus., Biological Survey collection.)

PLATE V.

[Three-fourths natural size.]

- FIG. 1. *Marmota monax monax*, ♂ adult, Peaks of Otter, Va. (No. 143962, U. S. Nat. Mus.)
2. *Marmota monax rufescens*, ♂ adult (type), Elk River, Minn. (No. 186521, U. S. Nat. Mus., Merriam collection.)
3. *Marmota monax preblorum*, ♂ adult, Wilmington, Mass. (No. 78355, U. S. Nat. Mus., Biological Survey collection.)
4. *Marmota monax ignava*, ♂ adult, L'Anse au Loup, Labrador. (No. 8871, Mus. Comp. Zool.)

PLATE VI.

[Three-fourths natural size.]

- FIG. 1. *Marmota monax canadensis*, ♂ adult, Murray Bay, Quebec. (No. 7603, Field Mus. Nat. Hist.)
2. *Marmota monax petrensis*, ♂ adult (type), Revelstoke, British Columbia. (No. 203532, U. S. Nat. Mus., Biological Survey collection.)
3. *Marmota monax ochracea*, [♂ ?] subadult, Babine Mountains, British Columbia. (No. 202785, U. S. Nat. Mus., Biological Survey collection.)
4. *Marmota flaviventris warreni*, ♀ adult (type), Crested Butte, Colo. (No. 202937, U. S. Nat. Mus., Biological Survey collection.)

PLATE VII.

[Three-fourths natural size.]

- FIG. 1. *Marmota flaviventris flaviventris*, ♂ adult, Donner, Cal. (No. 100532, U. S. Nat. Mus., Biological Survey collection.)
2. *Marmota flaviventris parvula*, ♀ adult (type), Jefferson, Nev. (No. 93690, U. S. Nat. Mus., Biological Survey collection.)
3. *Marmota flaviventris avara*, ♂ adult, Okanogan, British Columbia. (No. 99759, U. S. Nat. Mus., Biological Survey collection.)
4. *Marmota flaviventris engelhardti*, ♀ adult, Beaver Mountains, Utah. (No. 158978, U. S. Nat. Mus., Biological Survey collection.)

PLATE VIII.

[Three-fourths natural size.]

- FIG. 1. *Marmota flaviventris nosophora*, ♂ adult, Sawtooth National Forest, Idaho. (No. 156924, U. S. Nat. Mus., Biological Survey collection.)
2. *Marmota flaviventris luteola*, [♂ ?] adult, Mount Lincoln, Colo. (No. 175, Mus. Comp. Zool.)
3. *Marmota flaviventris dacota*, ♂ adult, Bear Lodge Mountains, Wyo. (No. 65920, U. S. Nat. Mus., Biological Survey collection.)
4. *Marmota flaviventris obscura*, ♂ adult, Wheeler Peak, N. Mex. (No. 135504, U. S. Nat. Mus., Biological Survey collection.)

PLATE IX.

[Three-fourths natural size.]

- FIG. 1. *Marmota olympus*, ♂ adult, Olympic Mountains, Wash. (No. 6325, Field Mus. Nat. Hist.)
2. *Marmota caligata oxytona*, ♂ adult, Lake Thudade, British Columbia. (No. 202791, U. S. Nat. Mus., Biological Survey collection.)
3. *Marmota vancouverensis*, ♂ adult, Vancouver Island, British Columbia. (No. 12091, Mus. Vert. Zool., Univ. of California.)
4. *Marmota caligata caligata*, [♂ ?] adult, near Portage Bay, Alaska. (No. 131440, U. S. Nat. Mus., Biological Survey collection.)

PLATE X.

[Three-fourths natural size.]

- FIG. 1. *Marmota caligata cascadensis*, ♂ adult, head of Cascade River, Wash. (No. 42793, U. S. Nat. Mus., Biological Survey collection.)
2. *Marmota caligata nivaria*, ♀ adult, St. Marys Lake, Mont. (No. 72222, U. S. Nat. Mus., Biological Survey collection.)
3. *Marmota caligata okanagana*, ♂ adult, Glacier, British Columbia. (No. 67073, U. S. Nat. Mus., Biological Survey collection.)
4. *Marmota caligata oxytona*, ♀ adult (type), Head of Smoky River, Alberta. No. 174503, U. S. Nat. Mus.)

PLATE XI.

[Three-fourths natural size.]

- FIG. 1. *Marmota monax monax*, ♂ adult, Peaks of Otter, Va. (No. 143962, U. S. Nat. Mus.)
2. *Marmota monax rufescens*, ♂ adult (type), Elk River, Minn. (No. 186521, U. S. Nat. Mus., Merriam collection.)
3. *Marmota monax preblorum*, ♂ adult, Wilmington, Mass. (No. 78355, U. S. Nat. Mus., Biological Survey collection.)
4. *Marmota monax canadensis*, ♂ adult, Murray Bay, Quebec. (No. 7603, Field Mus. Nat. Hist.)

PLATE XII.

[Three-fourths natural size.]

- FIG. 1. *Marmota monax ignava*, ♂ adult, L'Anse au Loup, Labrador. (No. 8871, Mus. Comp. Zool.)
2. *Marmota flaviventris warreni*, ♀ adult (type), Crested Butte, Colo. (No. 202937, U. S. Nat. Mus., Biological Survey collection.)
3. *Marmota monax ochracea*, [♂ ?] subadult, Babine Mountains, British Columbia. (No. 202785, U. S. Nat. Mus., Biological Survey collection.)
4. *Marmota caligata nivaria*, ♀ adult, St. Marys Lake, Mont. (No. 72222, U. S. Nat. Mus., Biological Survey collection.)

PLATE XIII.

[Three-fourths natural size.]

- FIG. 1. *Marmota flaviventris flaviventris*, ♂ adult, Donner, Cal. (No. 100532, U. S. Nat. Mus., Biological Survey collection.)
2. *Marmota flaviventris parvula*, ♀ adult (type), Jefferson, Nev. (No. 93690, U. S. Nat. Mus., Biological Survey collection.)
3. *Marmota flaviventris avara*, ♂ adult, Okanogan, British Columbia. (No. 99759, U. S. Nat. Mus., Biological Survey collection.)
4. *Marmota flaviventris engelhardti*, ♀ adult, Beaver Mountains, Utah. (No. 158978, U. S. Nat. Mus., Biological Survey collection.)

PLATE XIV.

[Three-fourths natural size.]

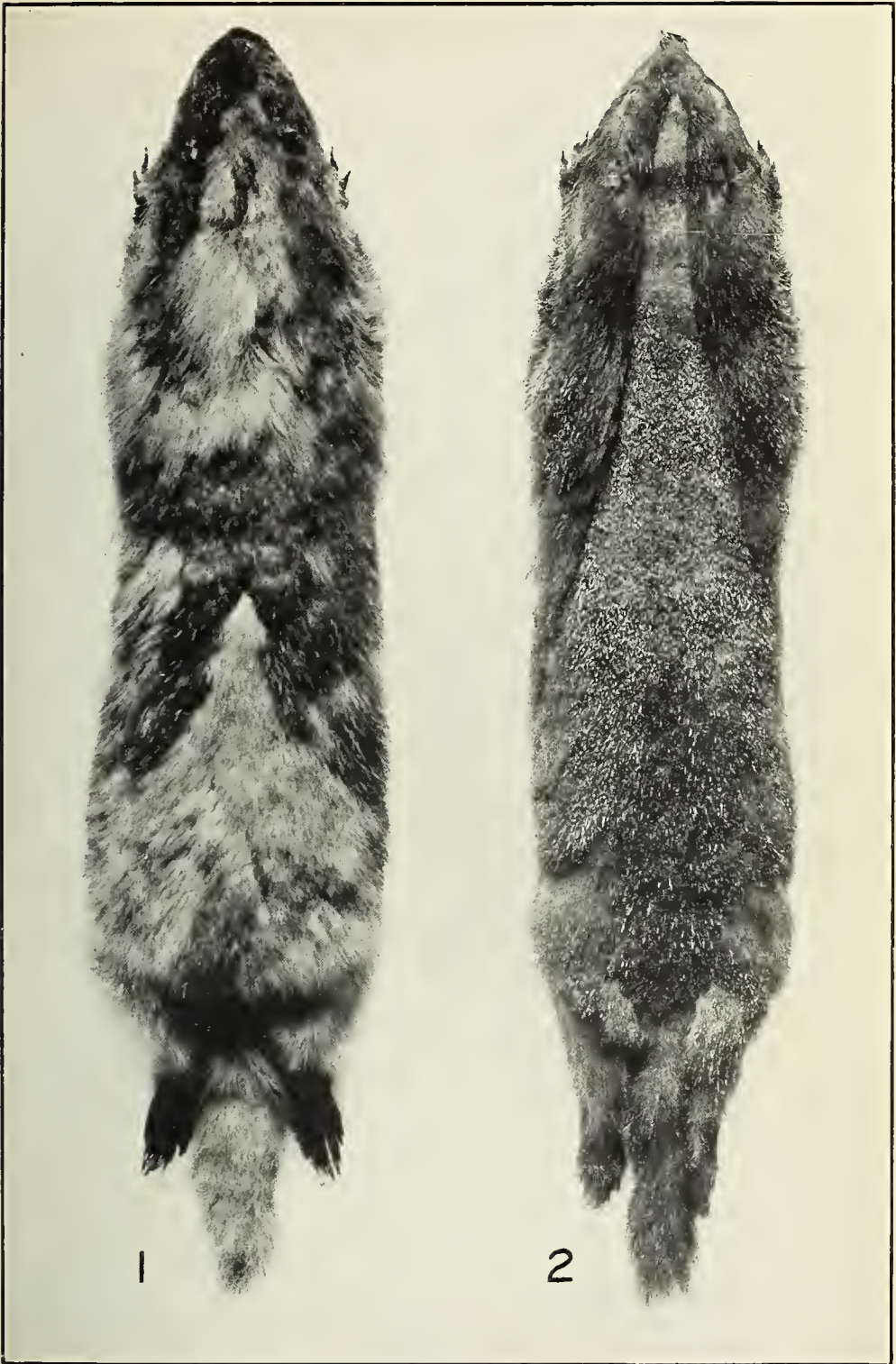
- FIG. 1. *Marmota flaviventris nosophora*, ♂ adult, Sawtooth National Forest, Idaho. (No. 156924, U. S. Nat. Mus., Biological Survey collection.)
2. *Marmota flaviventris dacota*, ♂ adult, Bear Lodge Mountains, Wyo. (No. 65920, U. S. Nat. Mus., Biological Survey collection.)
3. *Marmota flaviventris luteola*, [♂ ?] adult, Mount Lincoln, Colo. (No. 175, Mus. Comp. Zool.)
4. *Marmota flaviventris obscura*, ♂ adult, Wheeler Peak, N.Mex. (No. 135504, U. S. Nat. Mus., Biological Survey collection.)

PLATE XV.

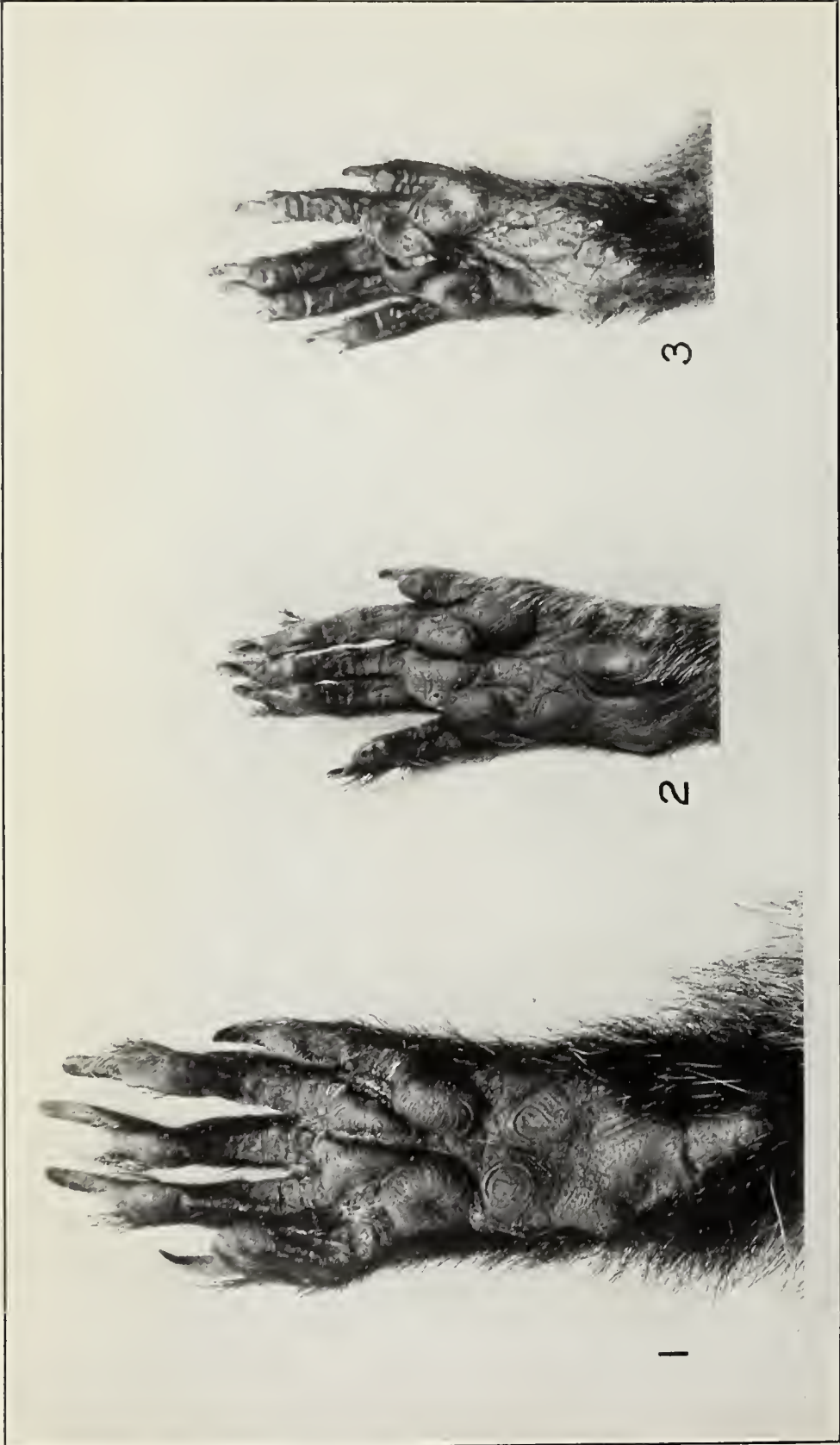
[Three-fourths natural size.]

- FIG. 1. *Marmota olympus*, ♂ adult, Olympic Mountains, Wash. (No. 6325, Field Mus. Nat. Hist.)
2. *Marmota vancouverensis*, ♂ adult, Vancouver Island, British Columbia. (No. 12091, Mus. Vert. Zool., Univ. of California.)
3. *Marmota caligata caligata*, [♂ ?] adult, near Portage Bay, Alaska. (No. 131440, U. S. Nat. Mus., Biological Survey collection.)
4. *Marmota caligata cascadenis*, ♂ adult, head of Cascade River, Wash. (No. 42793, U. S. Nat. Mus., Biological Survey collection.)



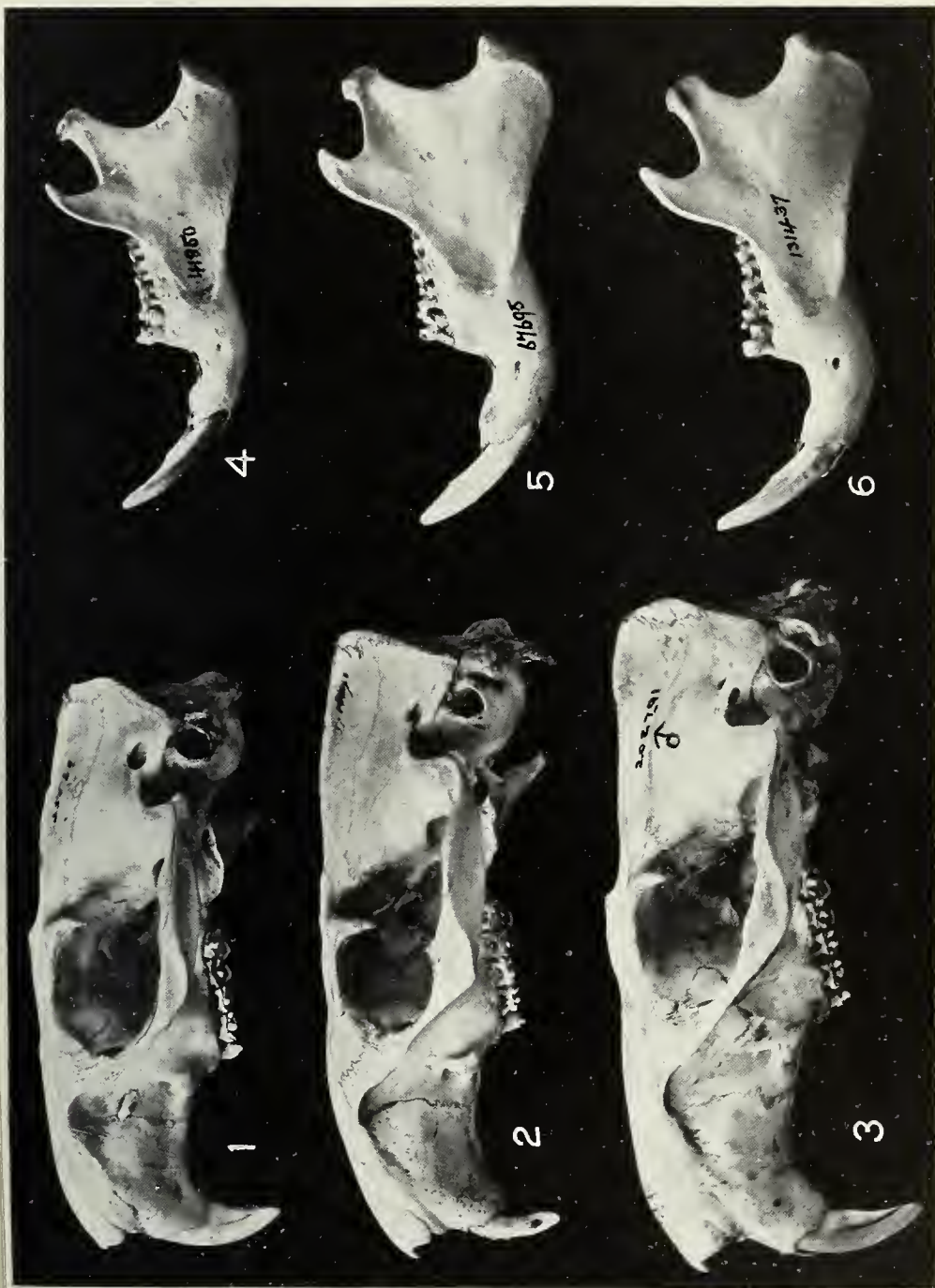


SKINS OF (1) MARMOTA OLYMPUS AND (2) M. FLAVIVENTRIS OBSCURA, SHOWING MOLT.



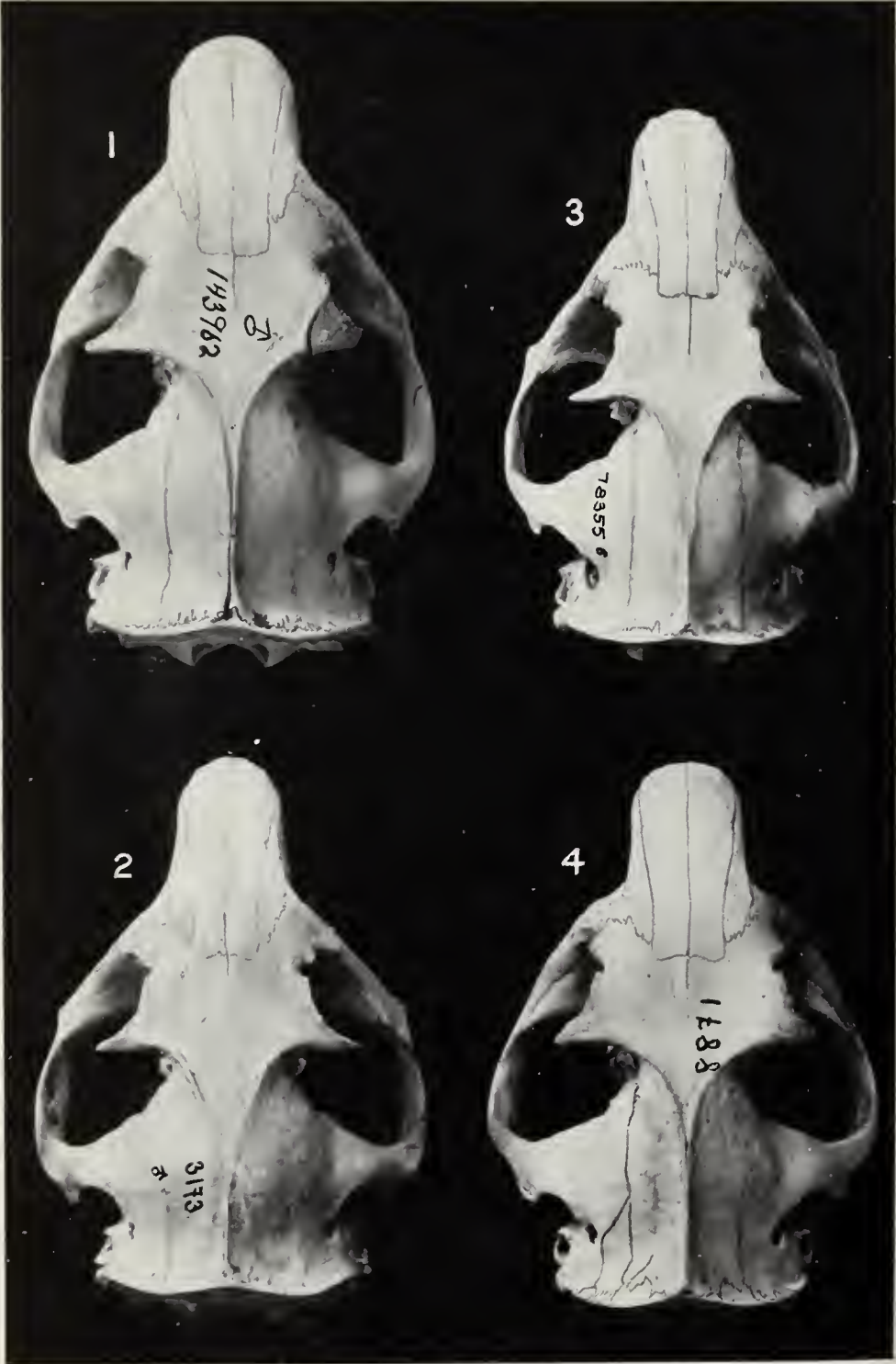
HIND FEET OF AMERICAN MARMOTS, SHOWING SOLE PADS.

- 1. *Marmota euligata oxytona*.
- 2. *Marmota flaviventris flaviventris*.
- 3. *Marmota monax probolorum*.



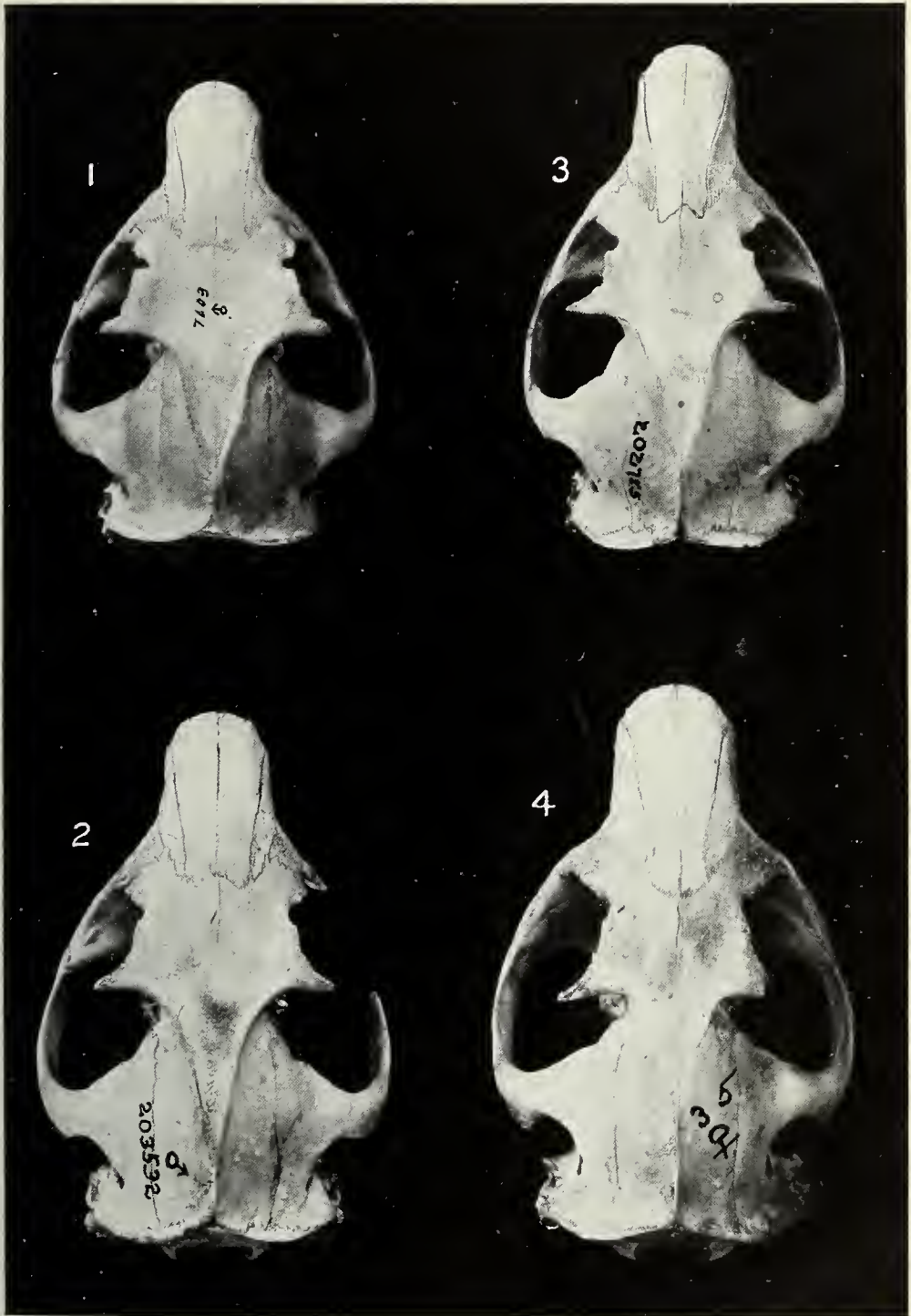
CRANIA AND MANDIBLES OF MARMOTA.

1. *M. flaviventris dacota*.
2. *M. monax monax*.
3. *M. caligata oxytona*.
4. *M. flaviventris sierrae*.
5. *M. monax rufescens*.
6. *M. caligata caligata*.



SKULLS OF MARMOTA.

1. *M. monax monax*. 3. *M. monax preblorum*.
2. *M. monax rufescens*. 4. *M. monax ignava*.



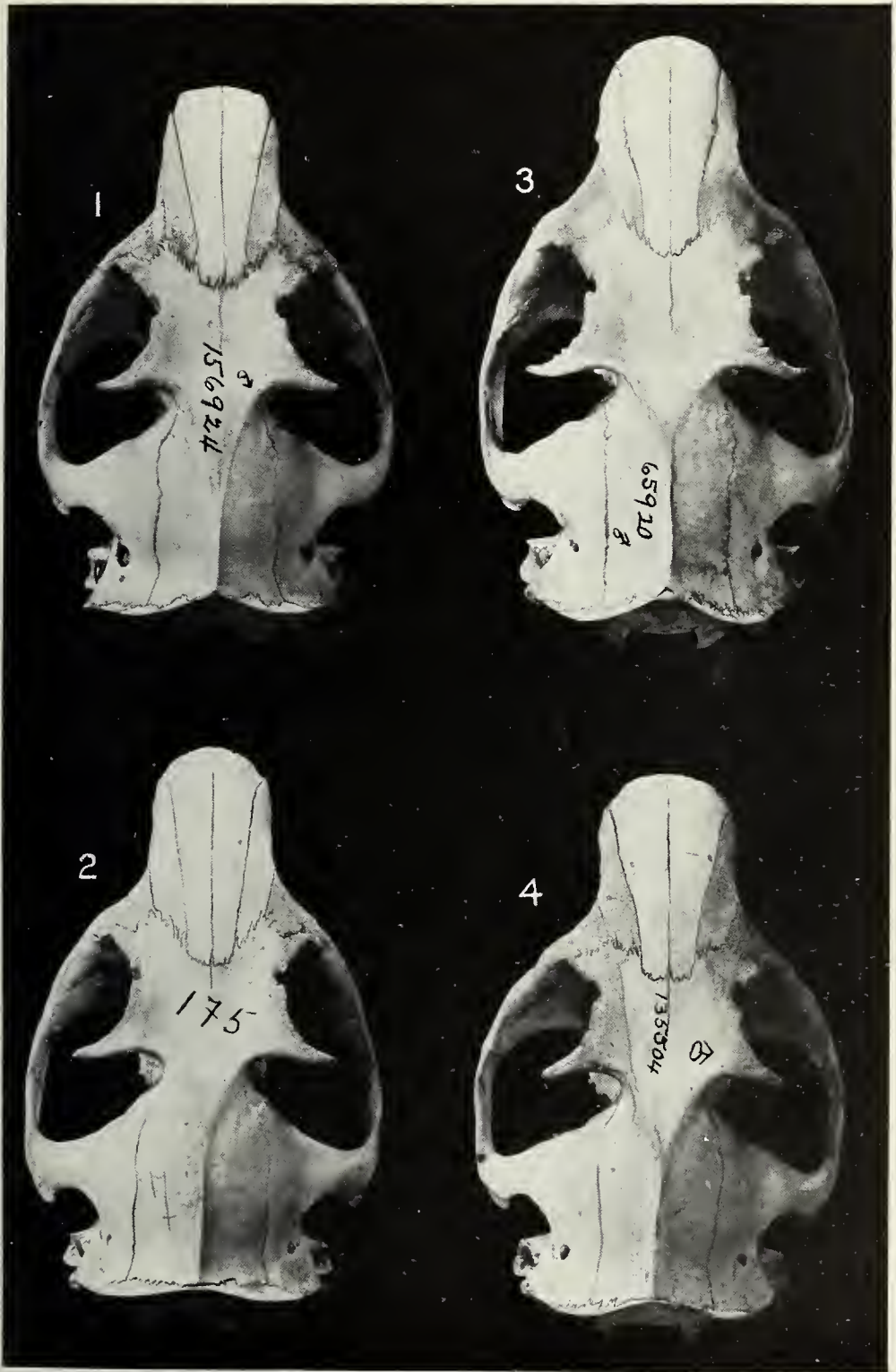
SKULLS OF MARMOTA.

1. *M. monax canadensis*. 3. *M. monax ochracea*.
2. *M. monax petrensis*. 4. *M. flaviventris warreni*.



SKULLS OF MARMOTA.

- 1. *M. flaviventris flaviventris*.
- 2. *M. flaviventris parvula*.
- 3. *M. flaviventris avara*.
- 4. *M. flaviventris engelhardti*.



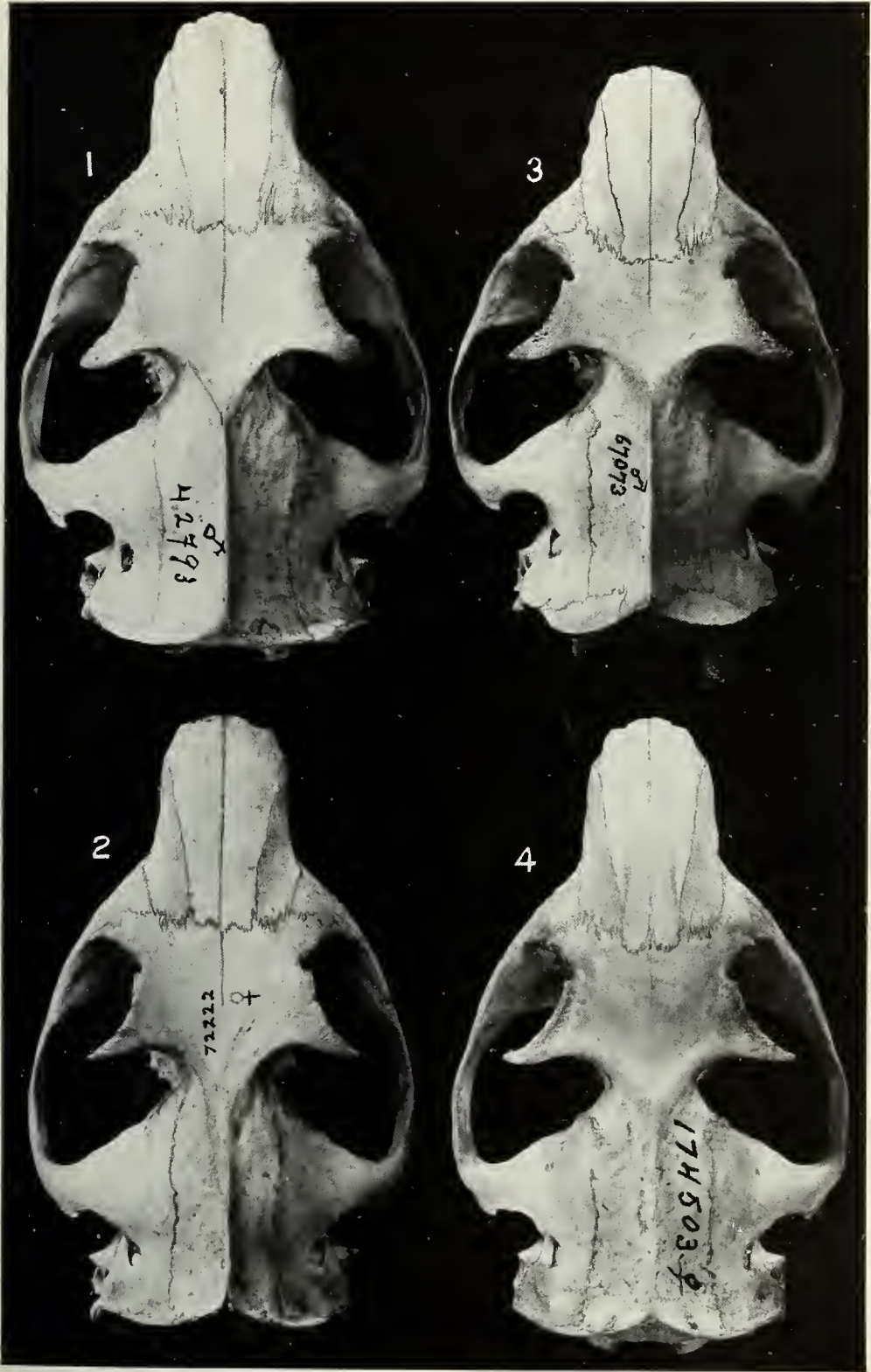
SKULLS OF MARMOTA.

1. *M. flaviventris nosophora*. 3. *M. flaviventris dacota*.
2. *M. flaviventris luteola*. 4. *M. flaviventris obscura*.



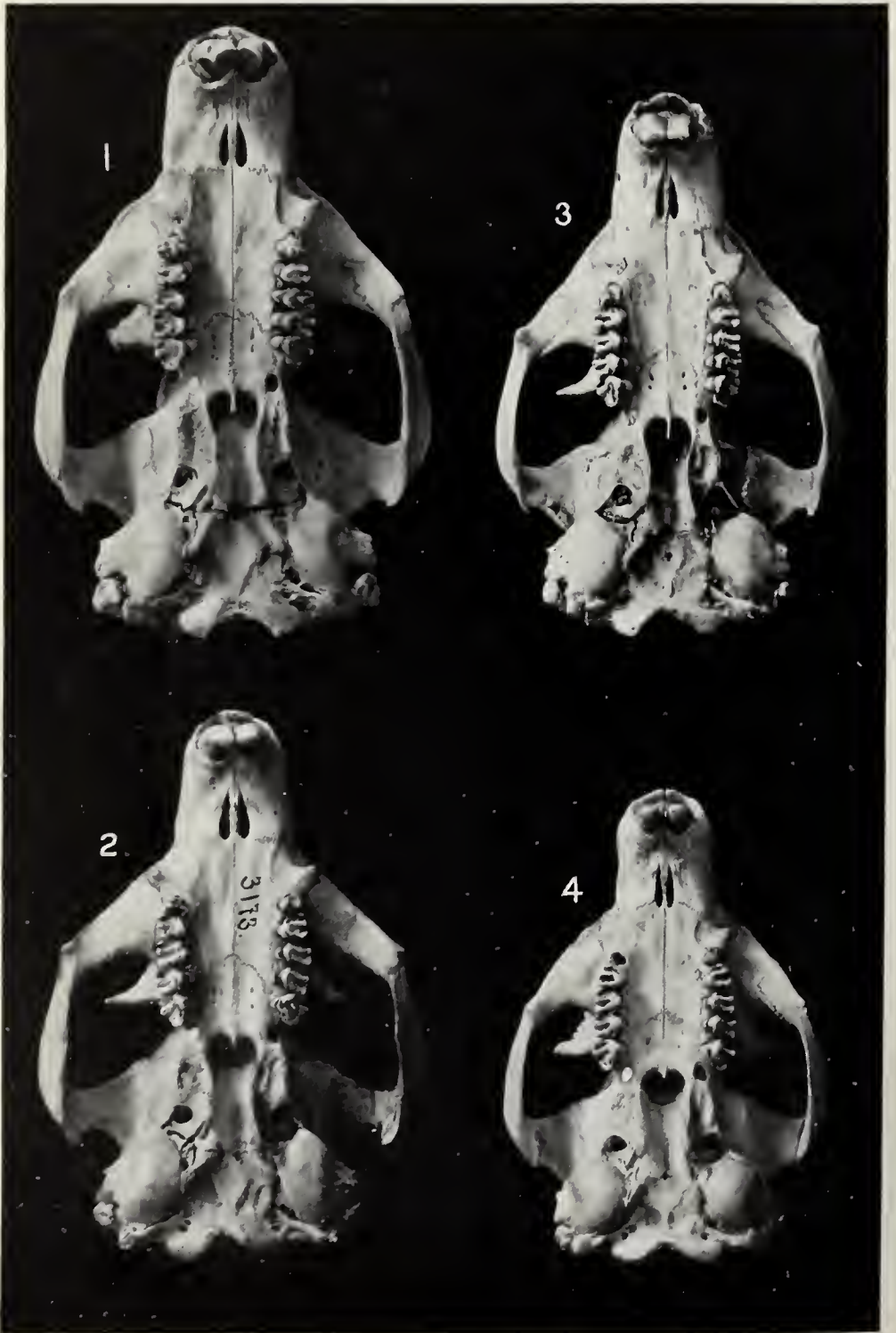
SKULLS OF MARMOTA.

- | | |
|---------------------------------|----------------------------------|
| 1. <i>M. olympus</i> . | 3. <i>M. vancouverensis</i> . |
| 2. <i>M. caligata oxytona</i> . | 4. <i>M. caligata caligata</i> . |



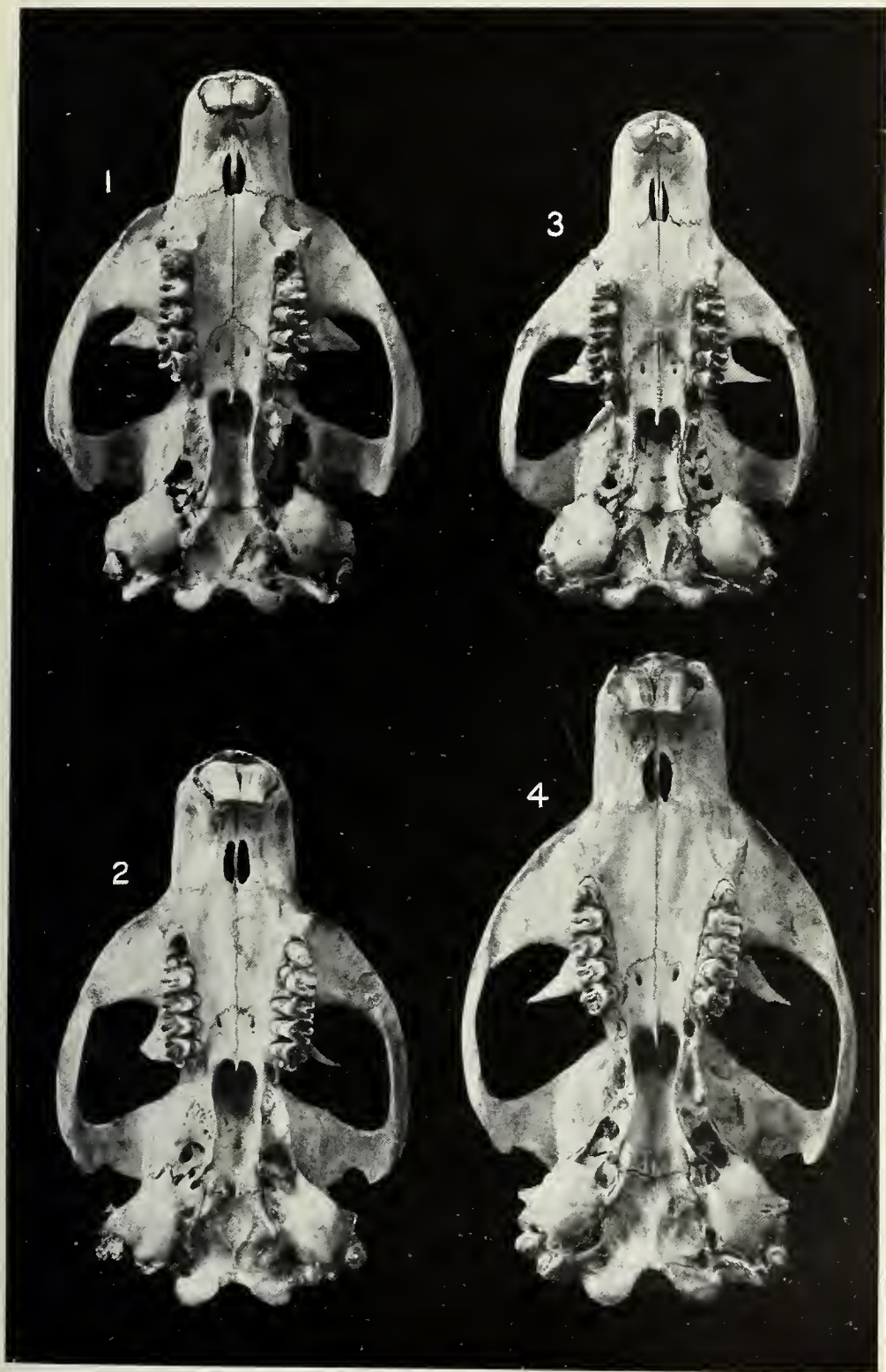
SKULLS OF MARMOTA.

1. *M. caligata cascadensis*. 3. *M. caligata okanagana*.
2. *M. caligata nivaria*. 4. *M. caligata oxytona*.



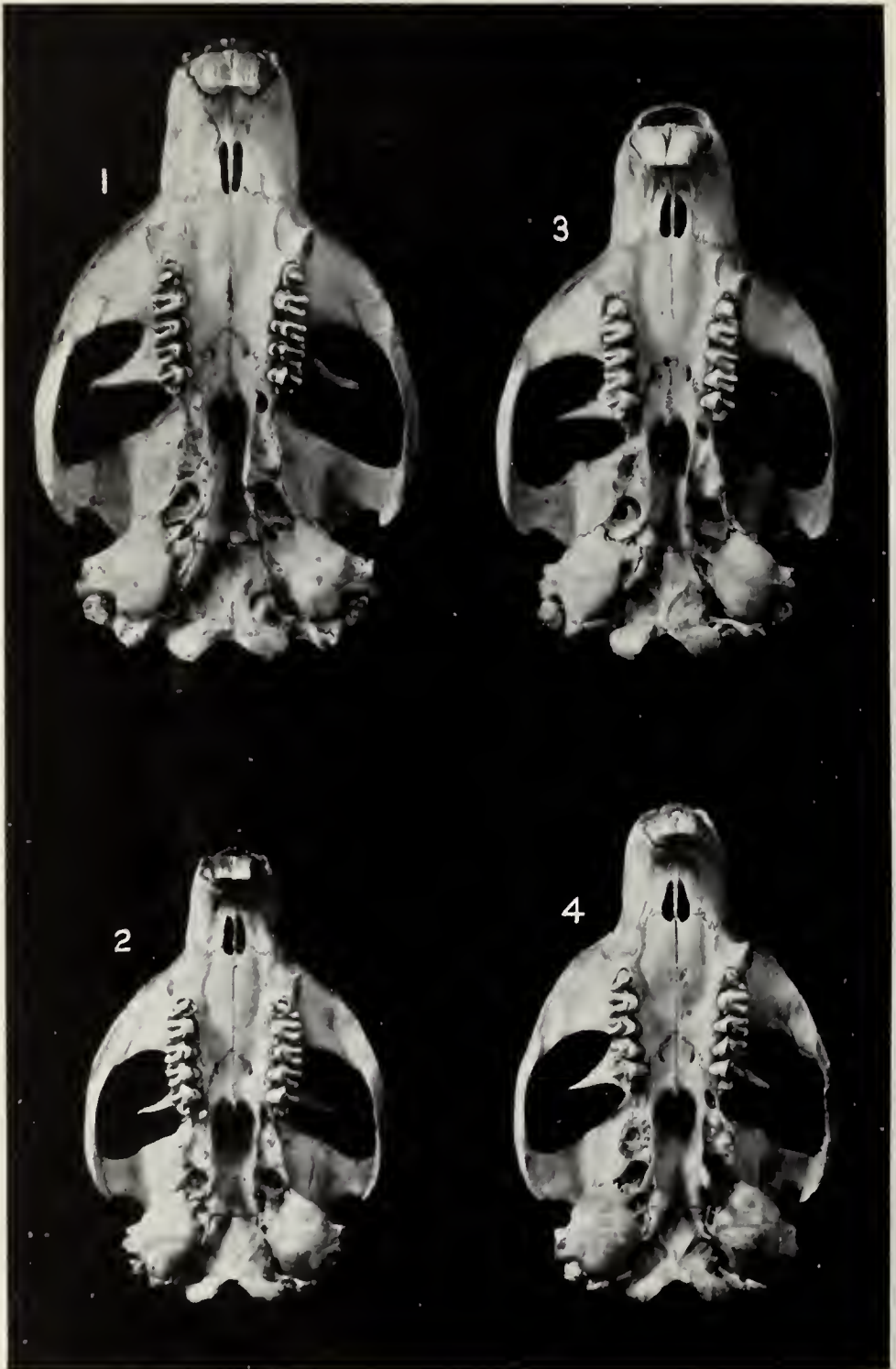
SKULLS OF MARMOTA.

1. *M. monax monax*. 3. *M. monax preblorum*,
2. *M. monax rufescens*. 4. *M. monax canadensis*.



SKULLS OF MARMOTA.

- | | |
|------------------------------------|--------------------------------|
| 1. <i>M. monax ignava.</i> | 3. <i>M. monax ochracea.</i> |
| 2. <i>M. flaviventris warreni.</i> | 4. <i>M. caligata nivaria.</i> |



SKULLS OF MARMOTA.

1. *M. flaviventris flaviventris*. 3. *M. flaviventris nvara*.
2. *M. flaviventris parvula*. 4. *M. flaviventris engelhardti*.



SKULLS OF MARMOTA.

1. *M. flaviventris nosophora*. 3. *M. flaviventris luteola*.
2. *M. flaviventris dacota*. 4. *M. flaviventris obscura*.



SKULLS OF MARMOTA.

- | | |
|-------------------------------|-------------------------------------|
| 1. <i>M. olympus</i> . | 3. <i>M. caligata caligata</i> . |
| 2. <i>M. vancouverensis</i> . | 4. <i>M. caligata cascadensis</i> . |

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